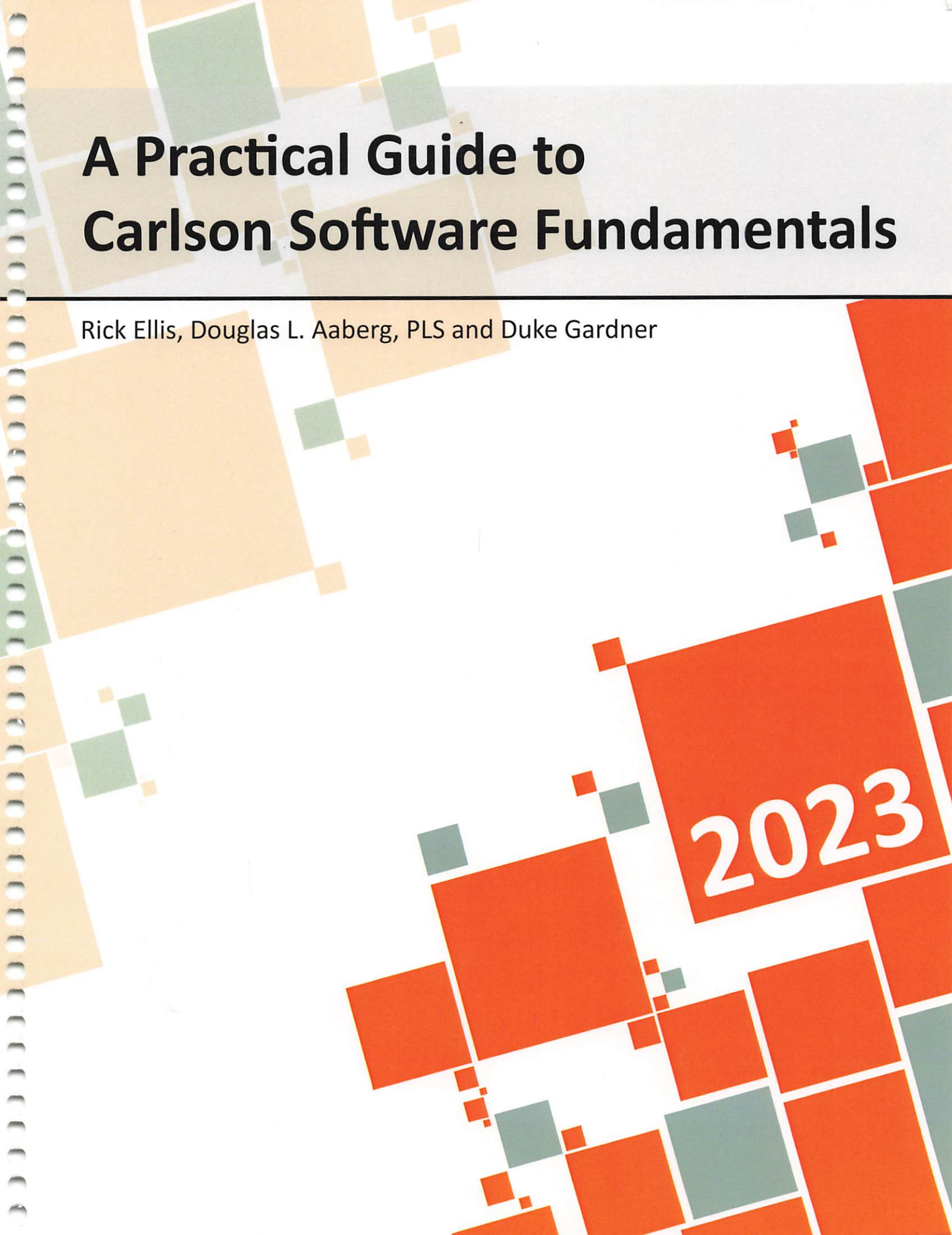
A Practical Guide to Carlson Software Fundamentals

Rick Ellis, Douglas L. Aaberg, PLS and Duke Gardner



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Rick Ellis
Douglas L. Aaberg, PLS
Duke Gardner

A CADapult Press Publication

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This practical background and approach has made him an award winning speaker at Autodesk University, a member of the national speaker team for the AUGI CAD Camps and a sought after instructor by organizations around the world.

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Duke Gardner has served the land surveying and civil engineering communities for over 35 years in a wide variety of support roles. His focus on the theory as well as the practice skills needed to achieve successful implementation made him an excellent partner in the author team for this guide.

Acknowledgements

Thank you to Carlson Software for their cooperation. A special thanks to Gary Rosen and Lauren Lax from Carlson Software for their assistance and encouragement. Without it this book would not have been possible.

Exercise Data

I would like to thank the City of Springfield, Oregon for providing the data for this book. The dataset provided is for illustration purposes only. While it is based on real world information to add relevance to the exercises, it has been altered and modified to more effectively demonstrate certain features as well as to protect all parties involved. The data should not be used for any project work and may not represent actual places or things. It is prohibited to redistribute this data beyond your personal use as a component of training.

A Practical Guide to Carlson Software Fundamentals 2023

Introduction

Congratulations on choosing this course to help you learn how to use Carlson 2023. The term "practical" is used in the title because this course focuses on what you need to effectively use Carlson Software, and does not complicate your learning experience with unnecessary details of every feature in the product.

Each lesson contains the concepts and principles of each feature to provide you with the background and foundation of knowledge that you need to complete the lesson. You then work through real world exercises to reinforce your understanding and provide you with practice on common tasks that other professionals are performing with Carlson Software in the workplace every day.

You can take the lessons in this course in whatever order is appropriate for your personal needs. If you want to concentrate on specific features, the lesson for those features does not require that you complete prior lessons. With this course organization, you can customize your own individual approach to learning Carlson.

When you complete this course, you will have the background and knowledge to apply Carlson Software to your job tasks, and become more effective and productive in your job.

Course Objectives

The objectives of this course are performance based. In other words, once you have completed the course, you will be able to perform each objective listed. If you are already familiar with Carlson Software, you will be able to analyze your existing workflows, and make changes to improve your performance based on the tools and features that you learn and practice in this course.

After completing this course, you will be able to:

- Navigate the Pull-down Menus and Ribbon Menus
- Set up Carlson Software to use the Project approach
- Work with Coordinate Files
- Draw Points into the Drawing
- Edit Points in the Drawing and External Point Database
- Create Point Groups
- Prepare Surface Data using Points and 3D Polylines
- Create Surface Models
- View and Edit Surfaces
- Perform Surface Inquiries
- Generate and Label Contours
- Perform Basic Drawing and Editing in CAD
- Import and Export Land XML Data
- Work with Google Earth and World files
- Work with Centerlines
- Generate Linework Labels
- Convert Carlson Point Blocks to Civil 3D Points
- Convert Civil 3D Point, Surface, Alignment and Label objects to Carlson data

Prerequisites

Before starting this course, you should have a basic working knowledge of AutoCAD®. A deep understanding of AutoCAD is not required, but you should be able to:

- Pan and Zoom in the AutoCAD drawing screen.
- Describe what layers are in AutoCAD, and change the current layer.
- Create basic CAD geometry, such as lines, polylines and circles.
- Use Object Snaps.
- Describe what blocks are, and how to insert them.
- Perform basic CAD editing functions such as Erase, Copy, and Move.

If you are not familiar with these functions, you can refer to the AutoCAD Help system throughout the course to gain the fundamental skills needed to complete the exercises.

For a more in-depth AutoCAD tutorial check out our book, ***A Practical Guide to AutoCAD 2023***.

Conventions

The course uses the following icons and formatting to draw your attention to guidelines that increase your effectiveness in Carlson Software, or provide deeper insight into a subject.

The magnifying glass indicates that this text provides deeper insights into the subject.

The compass indicates that this text provides guidance that is based on the experience of other users of Carlson Software. This guidance is often in the form of how to perform a task more efficiently.

Downloading and Installing the Datasets

In order to perform the exercises in this book, you must download a zip file and install the datasets.

Type the address below into your web browser to load the page where you can download the dataset.
www.cadapult-software.com/data

Unzip the Files

Unzip the file **APG_CARLSON_FUND_2023.zip** directly to the C drive. The dataset will be copied to the folder:

C:\Carlson Projects

A folder called **APG 2023 Data** is created that contains several folders with source data for the exercises in this book.

There are also folders created called **APG 2023 Lesson X_X** These folders contain project files and drawings where the lesson number of the folder corresponds to the lesson numbers in the book. This will allow you to jump in at the beginning of many of the lessons in the book, and do just the specific exercises that you want, if you do not have time to work through the book from cover to cover.

Exercises

The exercises in this course have been designed to represent common tasks that are performed by civil engineers, surveyors, designers and drafters. The data included in the exercises are typical drawings, point files and other data used by professionals like you. Exercises provide higher level process information throughout the exercise tasks. You are given information about not only what to do, but why you are doing it. Many images are included to help guide you.

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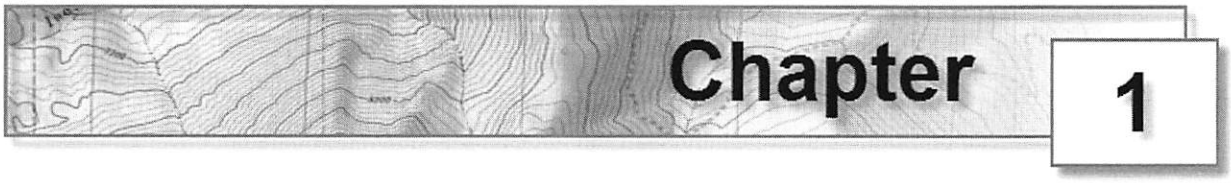


1 - A First Look at Carlson Software 2023

Welcome to *A Practical Guide to Carlson Software Fundamentals 2023*

Carlson Software offers a wide variety of desktop applications, each of which has unique capabilities. However, there is also an extensive collection of tools and functionalities that are common to them all, and that is the focus of this Practical Guide. It is designed to provide you with a comprehensive introduction to the fundamental features and functions, the theory and practice, of the parts of Carlson Software 2023 common to all its desktop applications. This text approaches this material in a logical and systematic manner, introducing you to the software and the available tools in a progressive sequence of lessons that will quickly lead you to a successfully implementation of the desktop programs.

In this text, you will learn how to navigate the menus, set up new drawings and projects, organize and maintain external data, work with points and surfaces, and efficiently utilize a variety of basic drawing and editing commands in Carlson, and familiarize yourself with a super set of miscellaneous power tools within the software.

By design, not every command and capability found in common in all Carlson desktop applications is covered in this text. The intent of this book is to serve as a comprehensive introduction to the essentials of the family of desktop programs, for the new end user or the veteran alike. This is a starting point for all users of Carlson office software, who will certainly significantly benefit from a clear understanding and strong level of confidence with all of the material in this text. From there, different users will explore and learn the tools specific to each of the desktop programs they utilize, but starting by learning these lessons thoroughly will provide a solid foundation to build on, and serve you well for a long time to come.

The Alternate Installations and Versions of Carlson Software's 2023 Applications

Carlson Software's 2023 collection of desktop applications can all be installed on any version of AutoCAD from 2017 to 2023, including "plain" AutoCAD, AutoCAD Map 3D, or AutoCAD Civil 3D. They also come with an alternative CAD engine called IntelliCAD. The choice of which platform to use is made on installation.

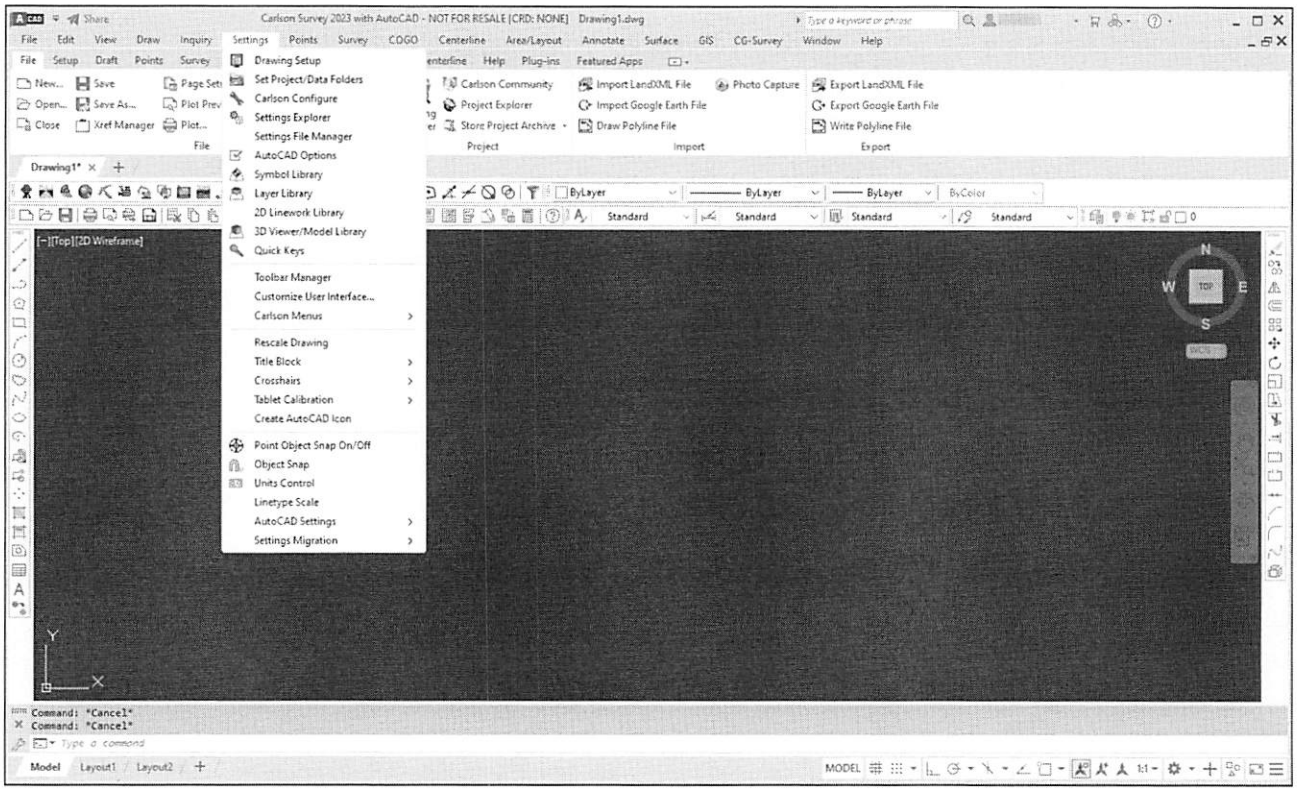
Two applications, Carlson Survey OEM 2023 and Takeoff R12, offer another way to purchase the software. They come with an AutoCAD engine made by Autodesk embedded in the program. This is not the full AutoCAD program, but a subset of AutoCAD that provides the basic commands needed to produce drawings, such as the standard drawing and editing commands, plotting, and paper space.

While the functionality of Carlson Software's desktop applications is very similar regardless of the CAD engine platform on which it operates, there are some differences. The graphics in this book are taken from Carlson 2023 running on AutoCAD 2023.

1.1 Lesson: A Guided Tour through the Pull-down Menus

Introduction

In this lesson, you will take a comprehensive look through the various pull-down menus that are shared by all the *Carlson 2023 desktop applications.* This will provide a good way to start learning what capabilities reside within the software and where they can be found.



Key Concepts

Concepts and key terms covered in this lesson are:

- The Overall Structure of the Pull-down Menus
- The General Content of the Pull-down Menus
- An Initial Indication of what is covered in this text

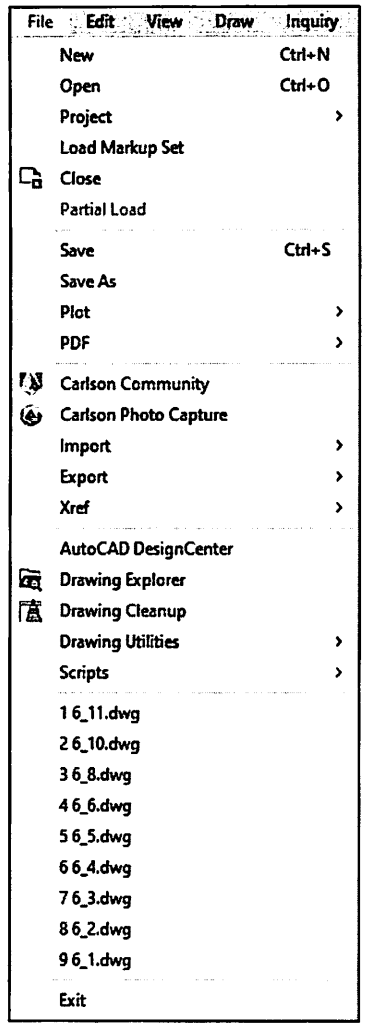
Objectives

After completing this chapter, you will be able to:

- Navigate the Pull-down Menus
- Describe the Major Features and Capabilities common to all Carlson 2023 desktop programs

The File Menu

First up is the File menu. This is of course where all of the standard file commands are found such as save, open, save as, etc., but it is also the home of several very important commands you may find yourself using frequently. These include a variety of Import and Export functions, including Import and Export of LandXML files, Civil 3D drawings, Google Earth files, and Microstation DGN files. The versatile Carlson Drawing Cleanup command is also accessed from here.



Carlson Community is for sharing point symbols, 3D models, and other files with Carlson Software users.

LandXML is a universal format for civil survey data, including point data, surfaces, alignments, parcels and other data types. LandXML Import and Export commands read and write these files which can be used to exchange data between applications, create permanent storage of project data files, and convert project data between Imperial and Metric units. The use of LandXML is covered in this text.

Google Earth Import and Export commands allow for reading files from Google Earth for context, and the generation of KML/KMZ files from your drawings for consumption in Google Earth. These commands are covered in this text.

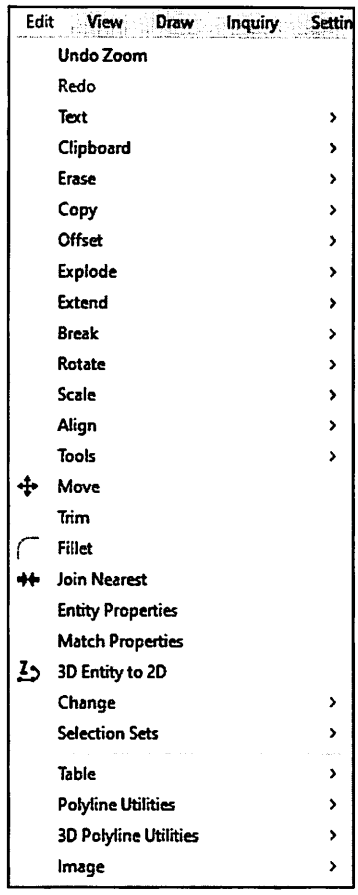
If you need to exchange data with Civil 3D users; Carlson Software can import Civil 3D Points, Alignments, Feature Lines, Pipes, Surfaces and Labels, converting them into AutoCAD objects and Carlson data files. Carlson Software can also export Carlson Points, Centerlines and TIN files directly to a Civil 3D drawing, creating Civil 3D objects without the need to have Civil 3D.

MicroStation DGN files can be converted to DWG, inserted as blocks or entities, or attached as XRef's to drawings. Drawing files can also be exported to DGN. If you are using Carlson Software with IntelliCAD you can open and edit DGN files directly.

Carlson Software's Drawing Cleanup command is a powerful function designed to find and correct an extensive list of common problems found in drawing files. The Drawing Cleanup command is covered in this text.

The Edit Menu

Next is the Edit menu. This menu contains a large assortment of tools to perform a wide array of editing functions. Many of the commands on this menu fly out sub menus with a mixture of standard AutoCAD editing functions combined with special Carlson enhanced routines to accomplish even more specific and complex actions.

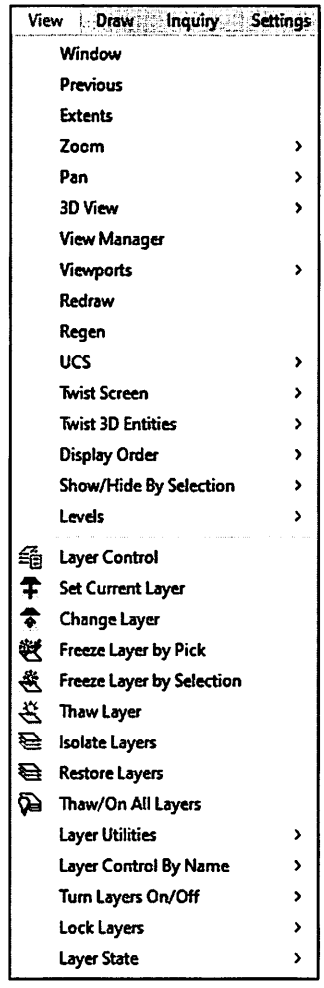


The bottom section of the edit menu contains a significant collection of utilities specifically for editing polylines. Because Carlson Software does not employ the use of any custom or proprietary objects that are not native to plain AutoCAD, there is extensive use of 2D and 3D polylines, and these tools are designed to facilitate their ease-of-use.

The View Menu

The View menu provides all of the standard view commands you would expect such as zoom, pan, and the ability to create saved views, as well as UCS manipulations, twist screen commands, and display order controls. Additionally, you will find the Carlson 3D Viewer for drawing objects, and the Carlson Surface 3D Viewer for viewing external TIN files. The Surface Viewer is used in this text.

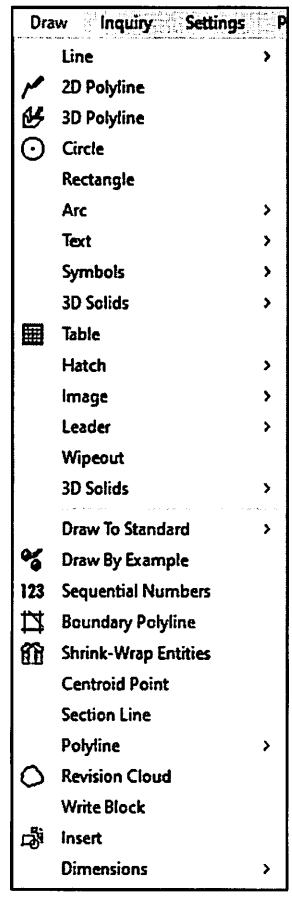
The view menu also contains special Carlson layer controls to freeze and isolate layers by picking objects.



The Draw Menu

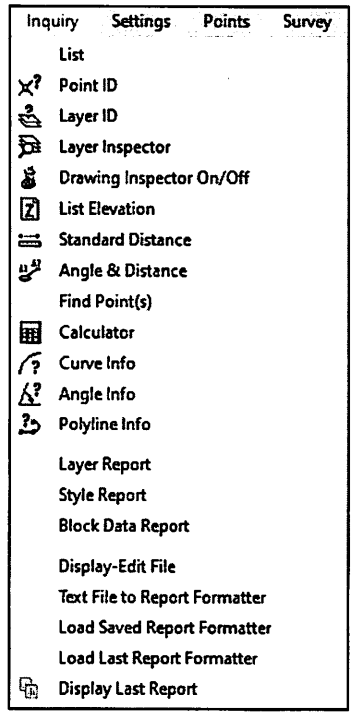
The Draw menu of course contains a wide array of drawing tools. Similar to the Edit menu, this menu contains a mixture of standard AutoCAD drawing tools combined with special Carlson drawing commands. For instance, the 2D Polyline command is actually a Carlson version of the AutoCAD polyline command with special options to further control the behavior of the polyline drawn.

The bottom half of the draw menu contains some very powerful Carlson drawing commands not found in plain CAD. Draw to Standard is a database driven function that provides the user access to predefined drawing entities. Shrink wrap entities is a Carlson function that draws a boundary around a selected set of entities, such as points.



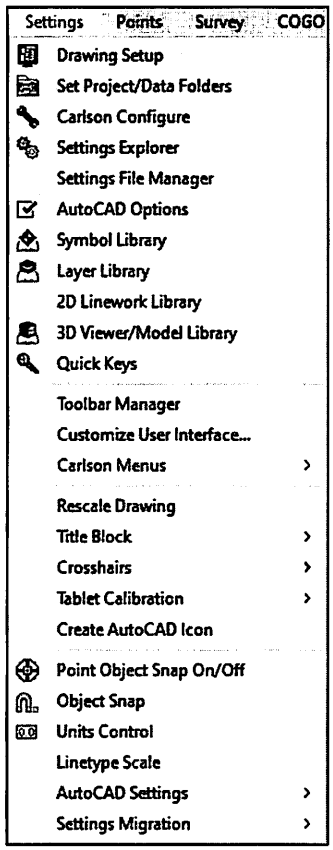
The Inquiry Menu

The Inquiry menu contains an extensive collection of commands designed to extract information from entities in your drawing, such as distance, area, elevation, and angular measure. This is also where can access the Drawing Inspector, an excellent tool that displays user-defined information simply by hovering over drawing entities. The use of the Drawing Inspector is covered in this text.



The Settings Menu

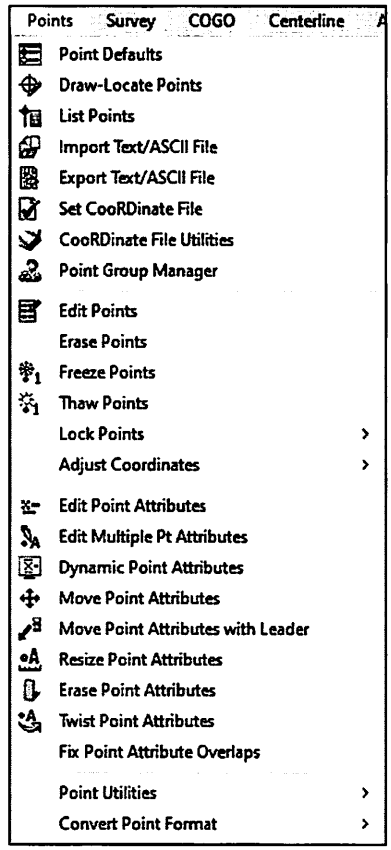
Next up is the Settings menu. All of your control over the Carlson environment as well as the CAD environment is accessed here. The Drawing Setup dialog box, Carlson Configure settings, symbol libraries, Quick Keys, and basic functions such as units control and point display are all found here. Drawing Setups and Quick Keys are covered in this text.



These first six menus that we have looked at are really general and generic CAD menus, providing dozens if not hundreds of commands to facilitate efficient and effective navigation of the CAD world, but not survey or civil engineering specific functionality. That capability begins with the next menu, *Points*.

The Points Menu

The Points menu is where all activity relating to point data is performed. Setting the coordinate file to be used, importing and exporting of text files, controlling the display of points in the drawing, and much more.



The Coordinate File Utilities dialog box serves as a master control center for all coordinate file functions and utilities. While many of the tools found here also have individual access from other parts of the Points menu, this dialog box is a great place to perform any type of coordinate file manipulations.

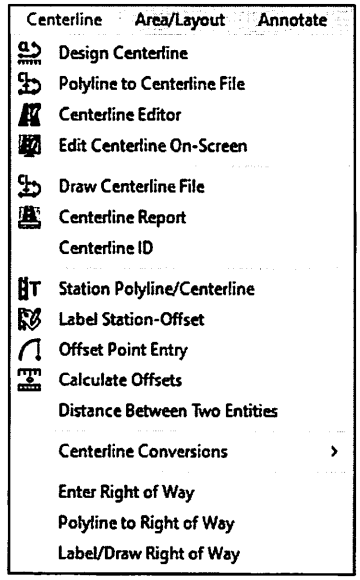
The Edit Point Attributes dialog box can be used to easily control a wide range of features associated with points, including the symbol, attached images, surface applicability, and others.

The Convert Point Format menu pick provides access to a considerable list of conversion utilities to move point data in and out of a wide variety of proprietary formats supported by other survey applications.

Much of the functionality of the Points menu is covered in this book.

The Centerline Menu

The Centerline menu is where all commands relating to 2D alignments are found. Carlson uses the term Centerlines to refer to 2D Alignments. There are several tools here to design and edit Centerlines. Centerlines are stored external to the DWG in .CL files. These files can be used to Draw Centerlines in the DWG and produce reports about them.

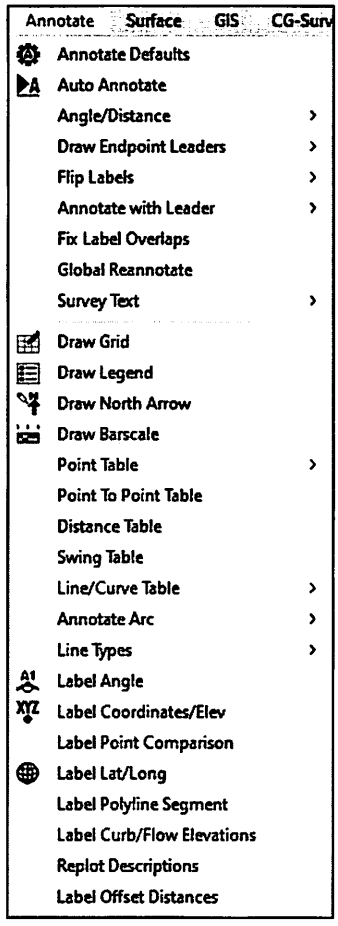


A Centerline in the DWG can be Stationed here, as well as annotated with other labeling options.

There are also a set of Conversion tools here to Import and Export Centerlines to and from other proprietary software formats.

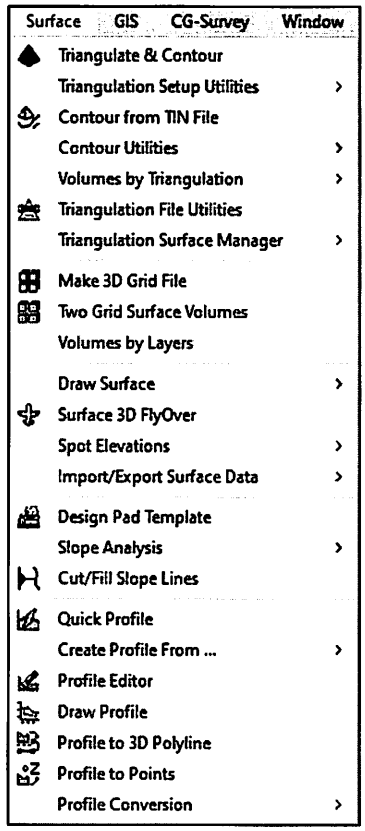
The Annotate Menu

The Annotate menu is where all labeling and plan embellishment utilities are located, including the labeling of lines and curves, addition of bar scales and North arrows, creation of legends, and generation of line and curve tables.



The Surface Menu

The Surface menu is where digital terrain models are built, contours are drawn, and volumes are measured. Design Pad Template allows the user to project slopes from a polyline at elevation intersecting the surface. The Surface menu also provides some profiling capability, projecting a 2D centerline on to a surface to generate a profile. Much of the functionality of the Surface menu is covered in this text.



The Help Menu

The Help menu is where you will find access to the Carlson Users Guide manual. If you are running on IntelliCAD, or AutoCAD, you can access their Help systems as well. There is also a link to Carlson's online training movies. You will also find access to the Command Search tool here.

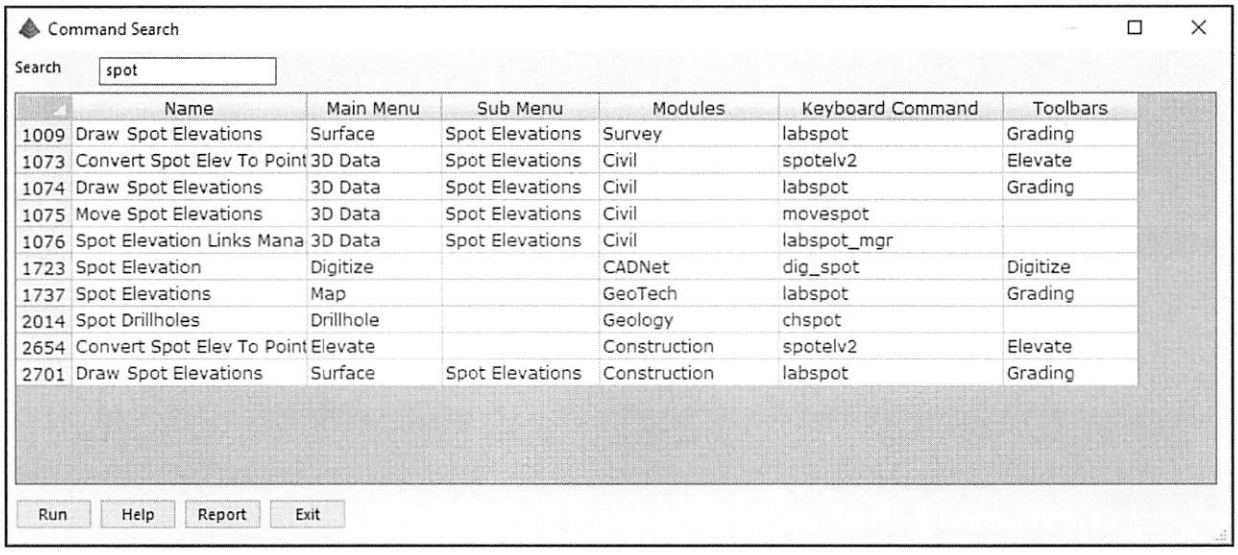
There are links to the Carlson website and discussion groups. You can even contact Carlson tech support directly from this menu.

"About Carlson" will show you the version and build of the software you are running, and you can also see your Serial Number here by picking "Registration" within the About Carlson dialog box.

Command Search

Command Search is a great way to find commands you are looking for. In the Command Search dialog box, as you type characters into the Search field, the list is reduced to display only the command names that include the characters you've typed in. The listing shows you the command name, along with what menu, and potentially sub-menu, it is found on, and what Module, or Program, it exists in.

Note that many commands are found in multiple Programs, and sometimes in different menu locations. The listing also includes the Keyboard equivalent of the command name, so you can type it in at the command line, or use it to customize Quick Keys.



	Name	Main Menu	Sub Menu	Modules	Keyboard Command	Toolbars
1009	Draw Spot Elevations	Surface	Spot Elevations	Survey	labspot	Grading
1073	Convert Spot Elev To Point	3D Data	Spot Elevations	Civil	spotelv2	Elevate
1074	Draw Spot Elevations	3D Data	Spot Elevations	Civil	labspot	Grading
1075	Move Spot Elevations	3D Data	Spot Elevations	Civil	movespot	
1076	Spot Elevation Links Mana	3D Data	Spot Elevations	Civil	labspot_mgr	
1723	Spot Elevation	Digitize		CADNet	dig_spot	Digitize
1737	Spot Elevations	Map		GeoTech	labspot	Grading
2014	Spot Drillholes	Drillhole		Geology	chspot	
2654	Convert Spot Elev To Point	Elevate		Construction	spotelv2	Elevate
2701	Draw Spot Elevations	Surface	Spot Elevations	Construction	labspot	Grading

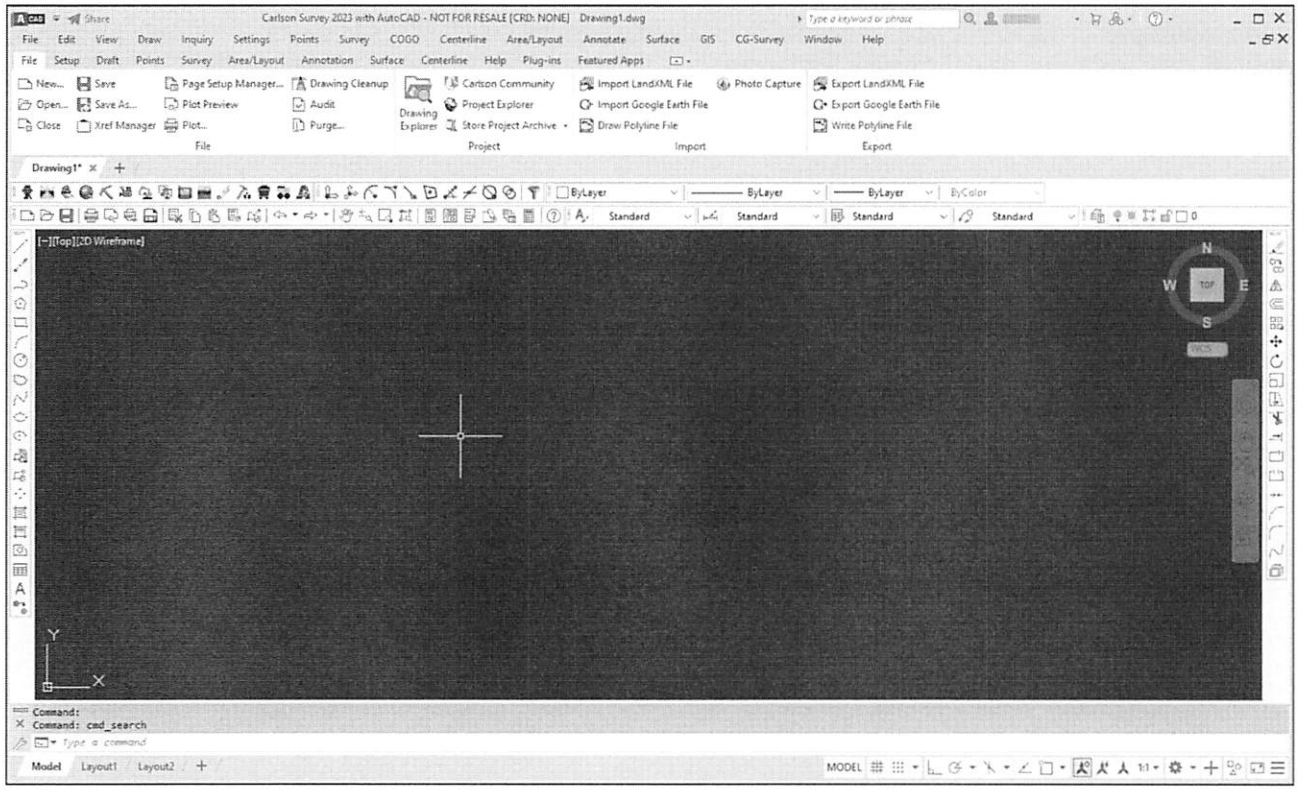
Lesson Review

In this lesson, you became familiar with the capabilities of *Carlson 2023* desktop applications, along with the layout of the pull-down menus in the program.

1.2 Lesson: A Guided Tour through the Ribbon Menus

Introduction

In this lesson, you will take a comprehensive look through the various ribbon menus common to all the *Carlson 2023 desktop applications.* This will provide a good way to start learning what capabilities reside within *Carlson 2023*, which ones are accessible through the ribbon menu interface, and where they are be found.


Carlson Survey 2023 with AutoCAD - NOT FOR RESALE [CRD: NONE] Drawing1.dwg
File Edit View Draw Inquiry Settings Points Survey COGO Centerline Area/Layout Annotate Surface GIS CG-Survey Window Help
File Setup Draft Points Survey Area/Layout Annotation Surface Centerline Help Plug-ins Featured Apps
New... Save Page Setup Manager... Drawing Cleanup
Open... Save As... Plot Preview Audit
Close Xref Manager Plot... Purge...
File
Drawing Explorer
Carlson Community Project Explorer Store Project Archive
Project
Import LandXML File Photo Capture Import Google Earth File Draw Polyline File
Import
Export LandXML File Export Google Earth File Write Polyline File
Export
Drawing1*
[-][Top][2D Wireframe]
ByLayer ByLayer ByLayer ByColor
Standard Standard Standard Standard
N W TOP E S
WCS
Y X
Command:
Command: cmd_search
Type a command
Model Layout1 Layout2
MODEL

Key Concepts

Concepts and key terms covered in this lesson are:

- The Overall Structure of the Ribbon Menus
- The General Content of the Ribbon Menus and Panels
- An Initial Indication of what is covered in this text and where they are in the Ribbons

Objectives

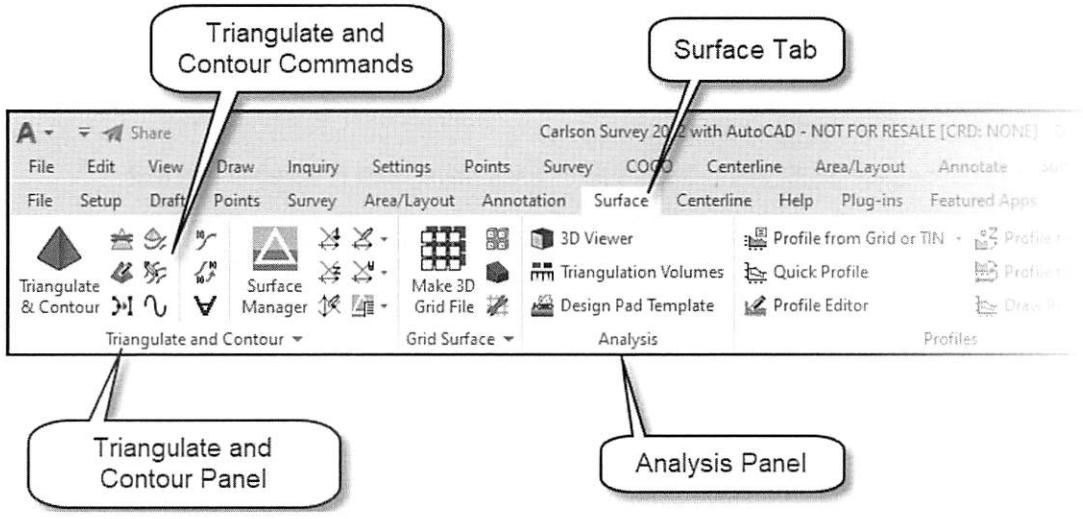
After completing this chapter, you will be able to:

- Navigate the Ribbon Menus
- Describe the Major Features and Capabilities common to the Carlson 2023 Desktop Applications

About Ribbons

Ribbons are an efficient user interface, first introduced in the Carlson Software applications with the *Carlson 2014* product line.

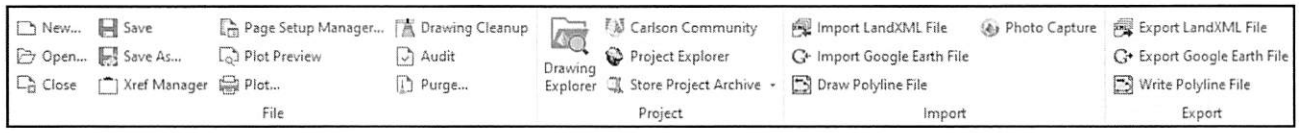
Ribbons are similar to menus but with more direct access to the most common commands you use. The following illustration provides definitions for the ribbon components.



The File Tab

The *File* tab divides the File commands into three panels:

- File
- Project
- Import
- Export



The File panel contains standard file functions, but also contains the powerful Drawing Cleanup command, which is discussed in this text.

The *Project* panel contains the Drawing Explorer, which shows a tree view of the data files associated with the current drawing, the Project Explorer, which shows a tree view of the data files associated with current Project, and the Store and Extract Project Archive commands.

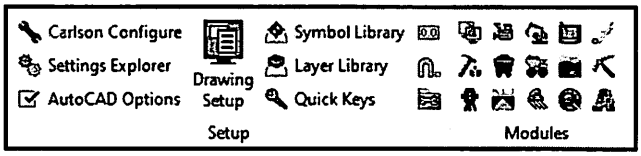
The *Import* panel contains LandXML, Google Earth and Polyline file Imports. LandXML and Google Earth Imports are covered in this text.

The *Export* panel contains LandXML, Google Earth and Polyline file Exports. LandXML and Google Earth Exports are covered in this text.

The Setup Tab

The Setup tab is divided into several panels:

- Setup
- Modules



The *Setup* panel is where you can access Drawing Setups and Quick Keys, both covered in this text.

The *Modules* panel is how you can change between whichever Carlson applications are activated with your Serial Number.

The Draft Tab

The Draft tab contains panels to perform all generic CAD drafting and editing functions. It is divided into several panels:

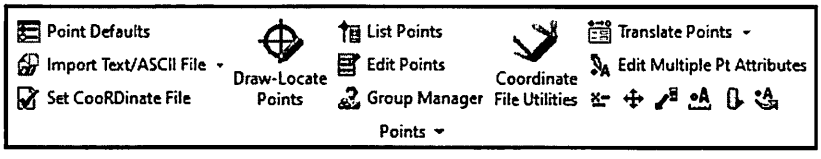
- Text
- Polyline
- Draw
- Inquiry
- Snap
- Edit
- Layers
- View
- CAD Standards

The many commands in these panels are generally not covered in this text, as they are generic CAD functions, which are not the focus of the book.

On the *Inquiry* panel, however, is the *Drawing Inspector*, a very important function that is covered in this text.

The Points Tab

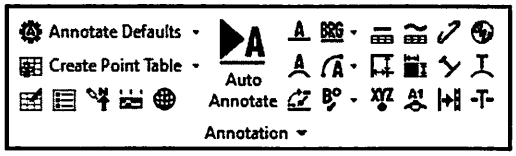
The Points tab contains only one panel also called *Points*.



Many Points commands are covered in this text and can be accessed from this panel.

The Annotation Tab

The Annotation tab contains only one panel also called *Annotation*.

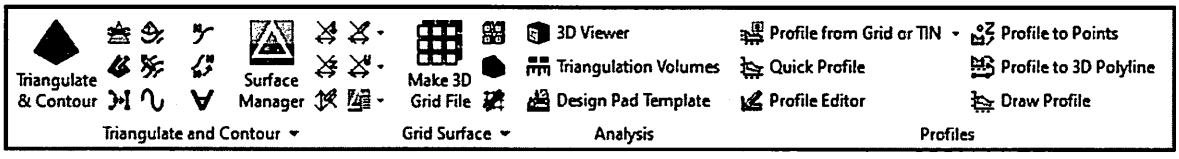


Many Labeling and Annotation commands are covered in this text and can be accessed from this panel, including the labeling of lines and curves, addition of bar scales and North arrows, creation of legends, and generation of line and curve tables.

The Surface Tab

The Surface tab in Carlson Software is divided into panels

- Triangulate and Contour
- Grid Surface
- Analysis
- Profiles



The *Triangulate and Contour* panel contains that command, the key command for Surface creation in Carlson Software, as well as Contour Labeling, and Surface Editing, all covered in this text.

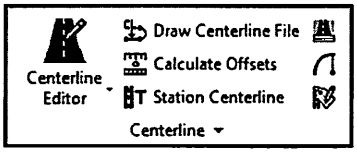
The *Grid Surface* panel covers the creation of these type of surface files, as well as several Grid File Utilities. Grid Files are not used in this text.

The *Analysis* panel contains the Surface 3D Viewer, which is an important surface tool, and is covered in this text.

The *Profiles* panel contains the Profiling commands in Carlson Software. This text covers the use of the Quick Profile functions, and the drawing of a Profile.

The Centerline Tab

The Centerline tab contains only one panel also called *Centerline*.



The Centerline Ribbon Tab is where you can design and edit Centerlines, Draw Centerlines in a DWG from external .CL files, Calculate Centerline Offsets, and Station Centerlines.

Lesson Review

That is an introduction and overview of what *Carlson 2023* brings to your desktop. As noted earlier, it is a lot to absorb, but do not be overwhelmed, you will access it a little at a time as you need it, and your familiarity and skill with these tools will grow surprisingly quickly.

Chances are you will employ a combination of pull-down menus and ribbons to run the program. Most of what you will need is available in the ribbons, but not every command. The pull-down menus contain every command in the program. Whichever way you access the program, this book will help you quickly learn the fundamentals of *Carlson 2023* and put them to use.

Now that you have an initial idea of what is available, let's get started setting up a new project, a new drawing, and accessing some typical civil/survey data.

2 - Working with Data, Settings, and Start Ups

Introduction

In this chapter, you are introduced to three critical areas of initial set ups in *Carlson* desktop applications. First up is how to work effectively and efficiently with external data associated with your drawings. Second are the General Settings that apply to all new drawings. Third is the actual set up of a new Project and Drawing.

These concepts are covered in the following lessons.

Lesson: Working with External Data

In this lesson we look at the different methods available to store external data files associated with your work. The Project method is then illustrated in detail.

Lesson: General Settings

Many Settings control the behavior of Carlson drawings. It is beneficial to have certain Settings apply to all drawings, while others will inevitably need to easily vary from drawing to drawing.

Lesson: Starting up a New Project and Drawing

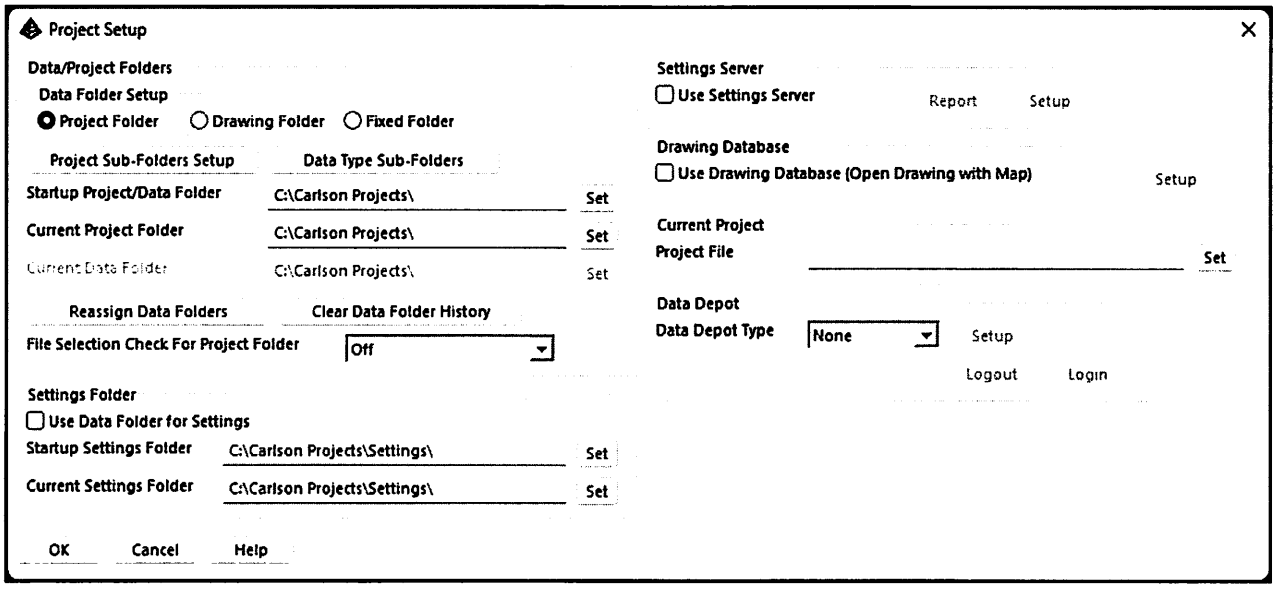
In this lesson we set up a new Project, and then start up a new a drawing assigned to that Project.

2.1 Lesson: Working with External Data

Introduction

The fundamental process of working with Carlson desktop applications involves operating within a CAD drawing environment, either on AutoCAD or on IntelliCAD, combined with regular interaction with a variety of external files, external to the drawing, which store the critical data used by the program. For this reason, it is extremely beneficial to understand and control this environment first and foremost. It is not a complicated undertaking, and this brief chapter is all you will need, but it is really an essential place to start.

In the lesson we look at the different methods available to store external data files associated with your work. The Project method is then illustrated in detail.



Key Concepts

Concepts and key terms covered in this lesson are:

- Data Folder Setup
- Project Sub-Folders Setup
- Data Type Sub-Folders
- Other Project Settings

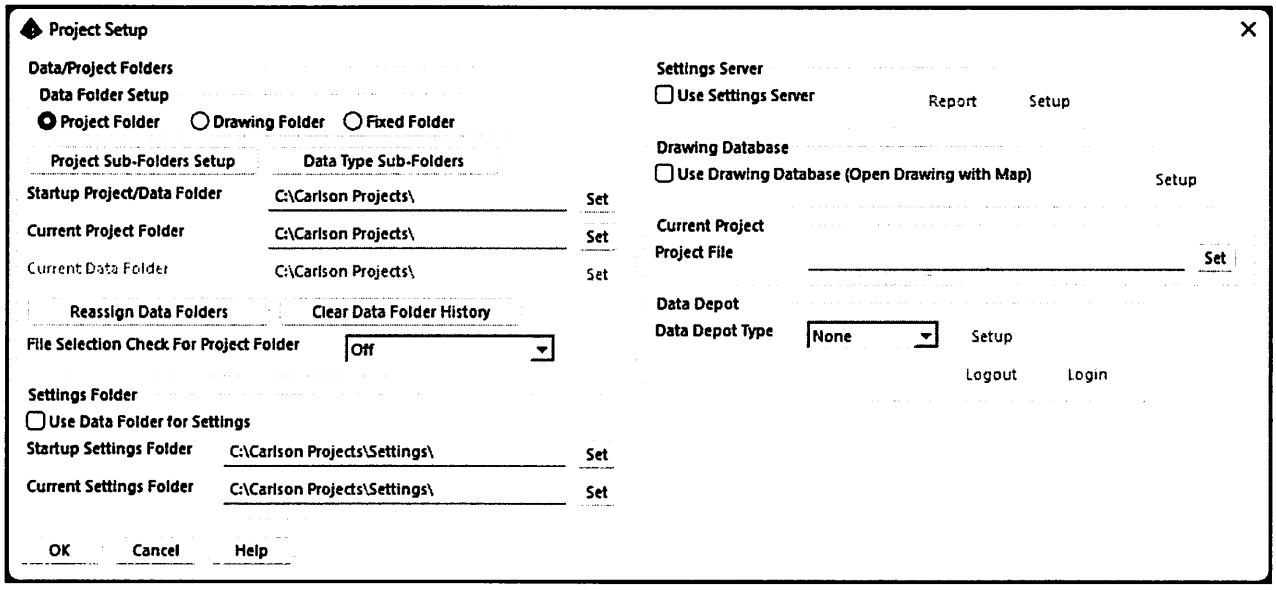
Objectives

After completing this chapter, you will be able to:

- Describe the options available to work with external data files
- Set up your working environment to work with Carlson Projects

Data Folder Setup

The **Data Folder** contains project specific data files such as Point data files, Centerline files, and Surface files.



There are three distinct options for managing your data represented by the three radio buttons at the top of the *Project Setup* dialog box:

- Project Folder
- Drawing Folder
- Fixed Folder

Project Folder

Project Folder, provides a somewhat more sophisticated approach which may be appropriate for many users, but not all. The idea here is to set up a template for a folder structure for each project you are working on, and let the program create this folder structure for you for each new project and automatically place the various external data files in the folder structure as you are working on the software.

If you select this option, two buttons for *Project Sub-Folders Setup* and *Data Type Sub-Folders* become available.

Drawing Folder

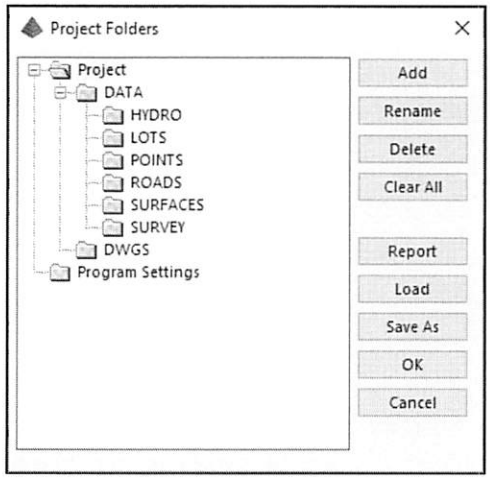
Drawing Folder is an option to have the software automatically store your external data files in whatever folder the drawing you are working on resides in. This is a reasonably acceptable option, as long as each drawing is carefully created and stored in a folder unique to the project you're working on. This option serves the purpose nicely for many users. It is clean and simple and easy to follow.

Fixed Folder

This option places all external data files in a single specific folder regardless of what project you are working on or what drawing you are in. To place all of these files from all of your jobs in a single folder would present a difficult situation to maintain in a well-organized fashion. For this reason it is not commonly used.

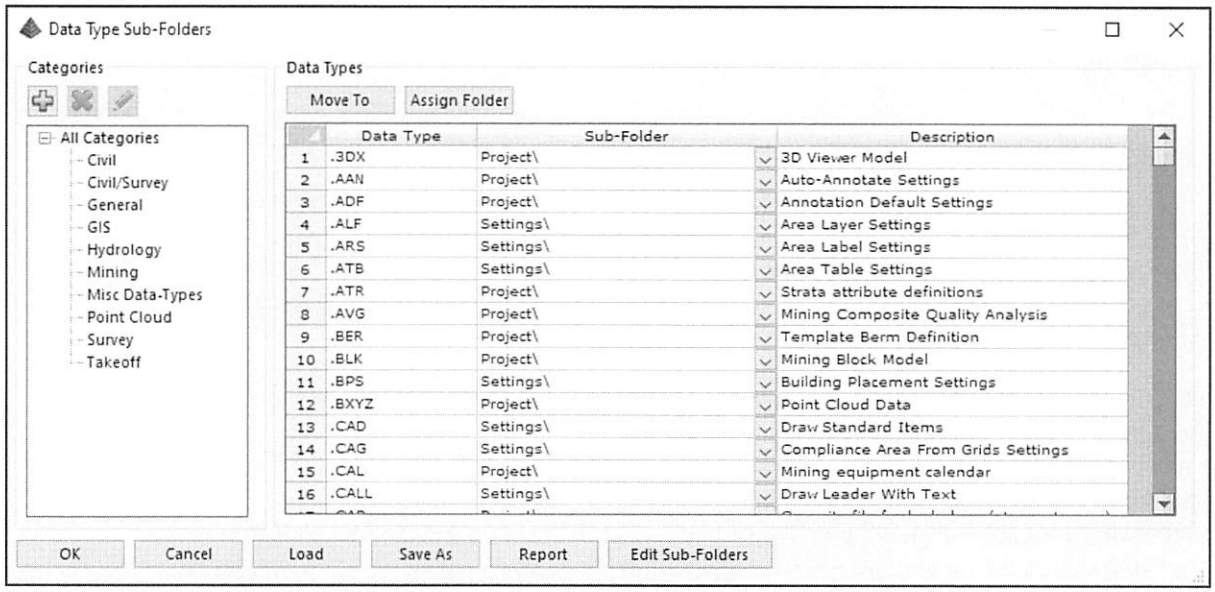
Project Sub-Folders Setup

Here you can create the structure of the folders and subfolders you wish to have created by the software for each new project you work on. You can start from scratch, and a simple one is provided to help get you started.



Data Type Sub-Folders

This dialog shows all of the external data file types created by Carlson programs. The purpose of this dialog box is to assign the Carlson data types to your folders. Since the program does not know what folders you may have created it cannot assign these automatically.



If you loaded the CSW folder structure and do not edit it, there is a CSW data type assignment file you can load to match it. This will provide an initial data storage environment for you to work in. As you grow the software you may decide to come back and make changes to this set up, but this initial approach will be an excellent way to get started.

Startup Project/Data Folder

The Startup Project/Data Folder is the default location that Carlson will look to read and write Project Folders. In a working office environment this is typically a network drive.

Settings Folder

The *Startup Settings Folder* is the default folder *Carlson Software* will utilize for the reading and writing of Carlson Settings files. Carlson uses many of these files to store the settings for the appearance and behavior of all drawing objects. For example, once you set up all the settings for how you want Profiles to look, those settings can be stored as an external .PFS file (Profile Settings). These different files are all named very simply and logically, to help facilitate the gaining of familiarity with them quickly and easily.

The *Settings Folder* specified here is the desired default location for these files. As with Projects, in a working office environment, the default location for these is typically a network drive, however for Settings, there is another potential problem with that. An organization is typically going to want to have "master" settings files on network, so all users can obtain similar results with their work, but they may need to be set to a read only state, so they cannot be overwritten. So sometimes end users will read "master" Settings from a network drive, but if they want or need to change some Settings to accomplish a specific task at hand, the customized Settings might be stored locally. This can be accomplished by setting the Startup Settings Folder to a network drive, read only location, and selecting the Use Data Folder for Settings option to save Settings to the Project Folder.

Settings Server

The *Settings Server* is a system designed for managing the multiple default and custom settings files that can be created in Carlson Software. This tool allows management of these settings to better control consistency throughout an organization. Annotation defaults, TIN creation, Field Code Tables, Profile settings etc. can all be saved on a network server and then populated on individual computers within the network. Updates to any settings can be performed automatically or manually.

Current Project

The Current Project, Project File is a file with a .PRJ file extension that stores a list of all of the drawings in a specific Project.

Data Depot Settings

Data Depot is a system for storage versioned copies of your project data. It is not discussed in detail in this book.

Exercise: Setting up Carlson Software to Work with External Data

In this exercise you set up the environment for Carlson Software to organize the external data files it needs to operate.

You do the following:

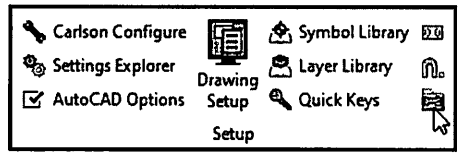
- Set up Project/Data folders
- Assign Carlson data files to folders

2.1.1 Setting up Carlson desktop applications to Work with External Data

1. Start Carlson 2023 from the desktop icon. Cancel or exit any initial startup dialog boxes that may be presented.

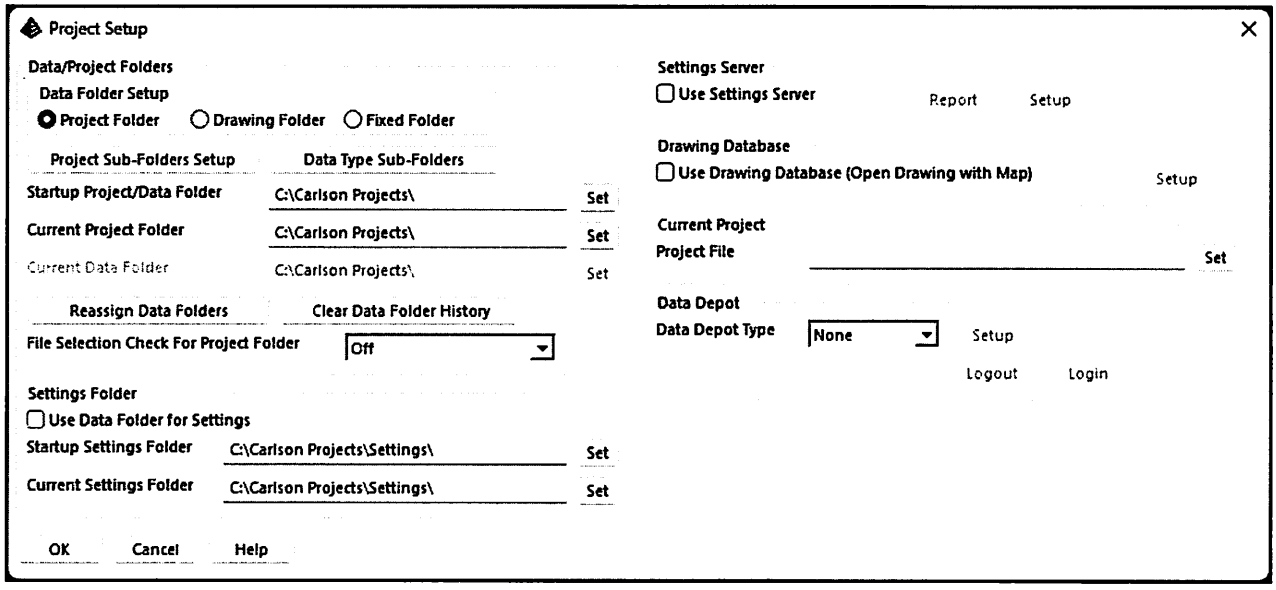
This allows you to set up the program to work with *Projects*, before actually starting a new drawing.

2. Select **Ribbon: Setup ⇒ Setup ⇒ Set Project/Data Folders.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Set Project/Data Folders.**

This opens the *Project Setup* dialog box.



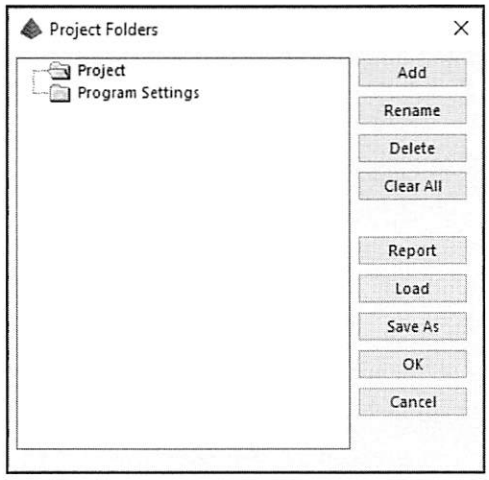
3. In the *Data Folder Setup* section select the **Project Folder** option.

This will allow you to set up a template folder structure that can be used for all your projects. The program will create this folder structure automatically for each new project and place the various external data files in the appropriate folders as you are working.

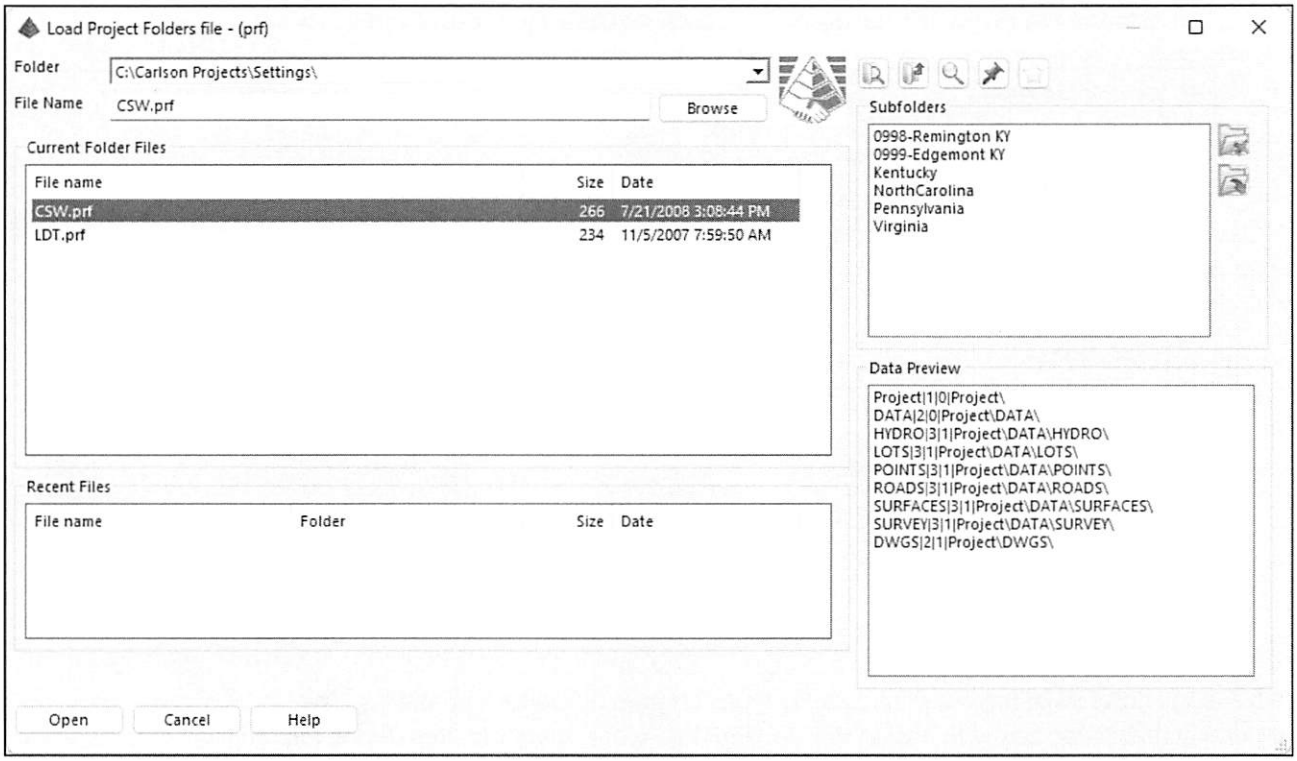
4. Click **<< Project Sub-Folders Setup>>**

This opens the *Project Folders* dialog box.

Here you can create the structure of the folders and subfolders you wish to have created for each new project. You can create this folder structure from scratch, or load an existing one.



5. Click **<<Load>>**.



6. Click **<<Browse>>**.

7. Browse to the file: **C:\Carlson Projects\Settings\CSW.prf** and open it.

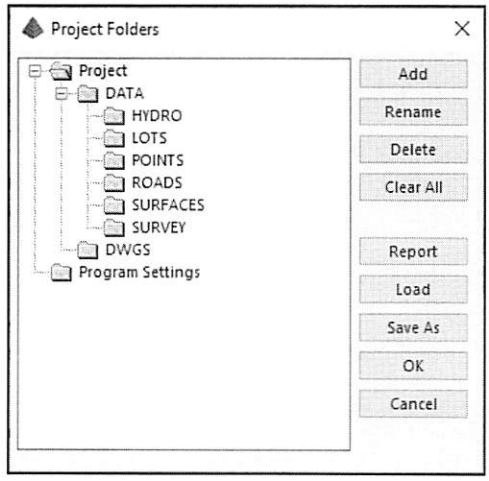
The CSW.prf file may also be found in the *C:\Carlson Projects* folder.

The CSW.prf file is a basic set of project folders provided with the software.

Back in the *Load Project Folders file* dialog box, you can review the folders the different project files are mapped to in the *Data Preview* section.

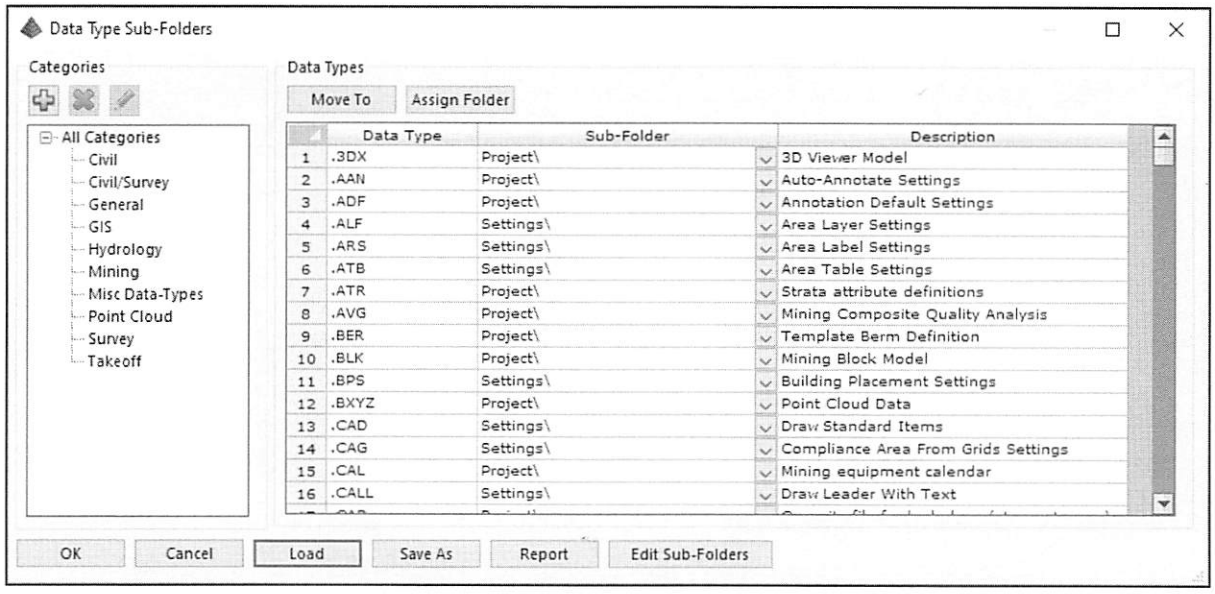
8. Click **<<Open>>** to load the project folders.

Back in the *Project Folders* dialog box, resulting folders can be edited added deleted or altered in any way that you desire.



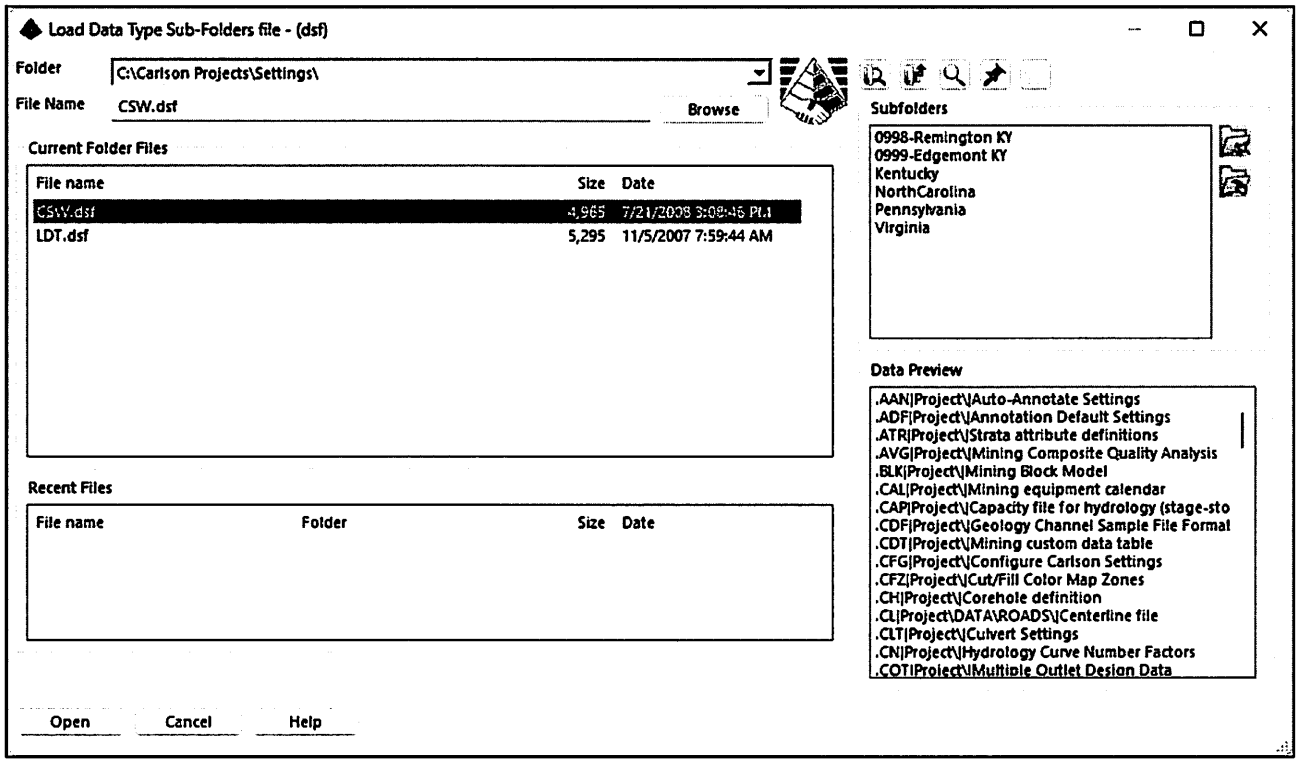
9. Click **<<OK>>**.

10. Back in the *Project Setup* dialog box, click **<< Data Type Sub-Folders>>**.



This dialog shows all of the external data file types created by Carlson programs. The purpose of this dialog box is to assign the Carlson data types to your folders. Since the program does not know what folders you may have created it cannot assign these automatically. However if you loaded the CSW folder structure and did not edit it, there is a CSW data type assignment file you can load to match it.

11. Click **<<Load>>**.

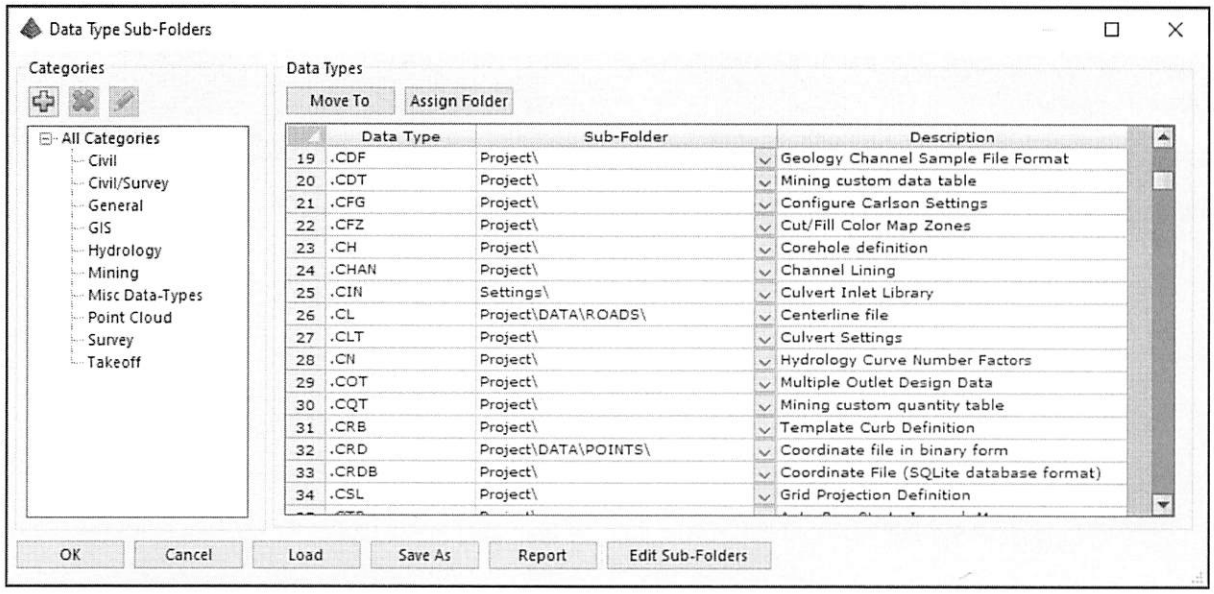


12. Click **<<Browse>>**.

13. Browse to the file: **C:\Carlson Projects\Settings\CSW.dsf** and open it.

Back in the *Load Data Type Sub-Folders file* dialog box, you can review how data is mapped in the *Data Preview* section.

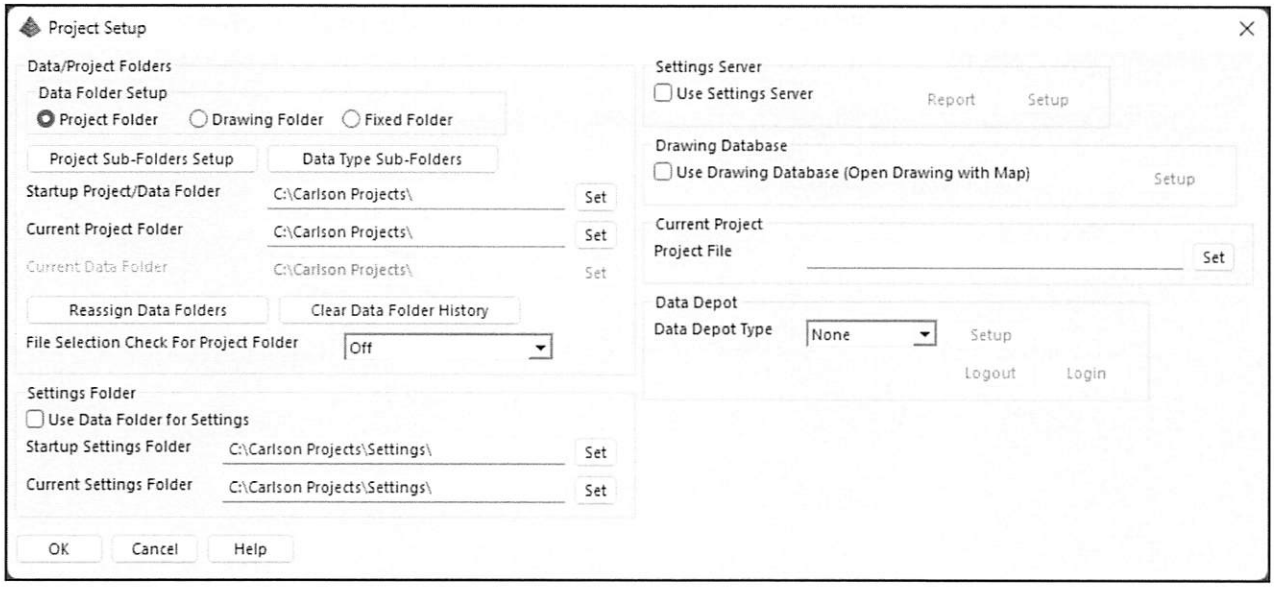
14. Click **<<Open>>** to load the data type sub-folders mapping.



Back in the *Data Type Sub-Folders* dialog box, you can review the results of loading the file and the current mapping of the different data types. You can also edit the data mapping any way that you desire.

This mapping from the *CSW.dsf* file will provide an initial data storage environment for you to work in that will be used for this book. However, as you grow the software you may decide to come back and make changes to this set up based on the needs of your organization and the projects you work on.

15. Click **<<OK>>**.



16. Back in the *Project Setup* dialog box, click **<< OK >>**.

Now you are ready set up a new project and a new drawing.

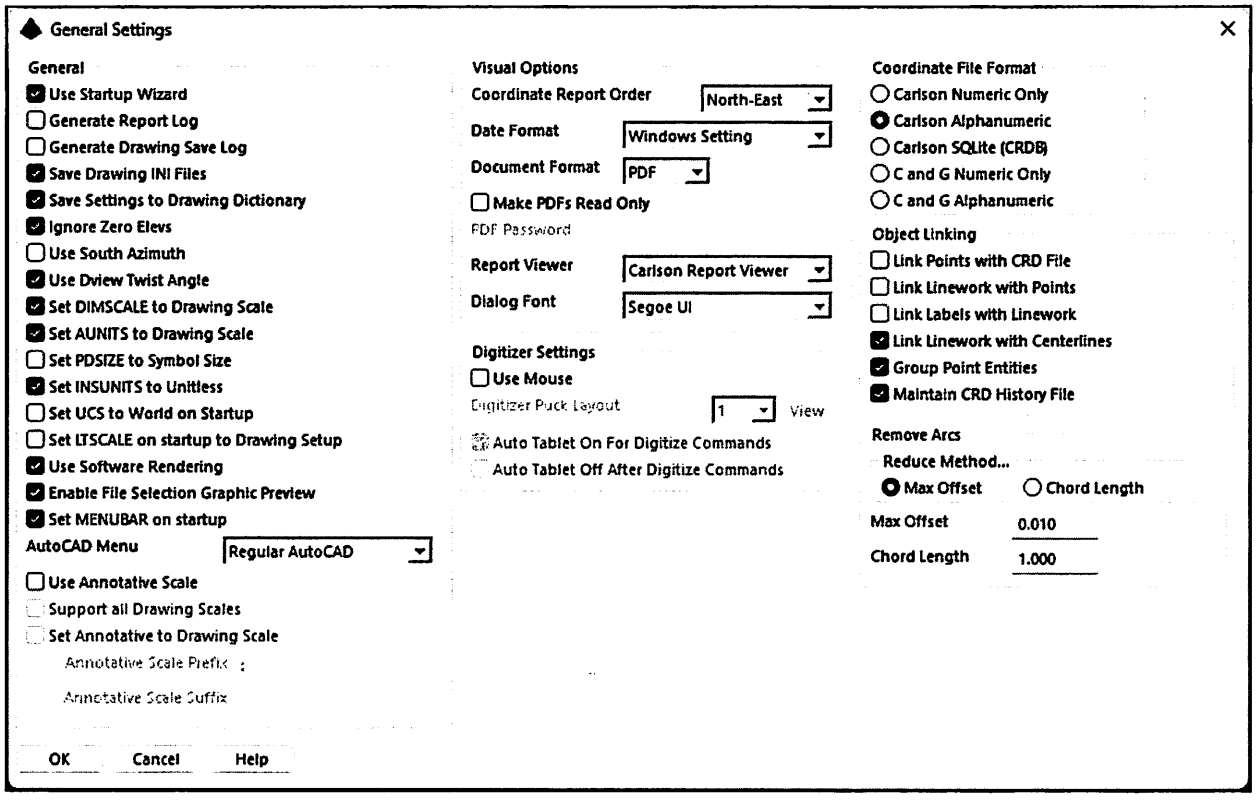
Lesson Review

In this lesson, we learned of the choices available in *Carlson Software* desktop applications to work with the external data it writes and reads. We then set up *Carlson Software* to work with Projects to store these collections of external data files. We also learned the purpose of other initial data and settings options.

2.2 Lesson: Setting Up General Settings

Introduction

In this lesson we look at the General Settings that apply to all new drawings. These are typically established early on and rarely changed.



Key Concepts

Concepts and key terms covered in this lesson are:

- Carlson Configure
- General Settings
- Object Linking
- Coordinate File Format

Objectives

After completing this chapter, you will be able to:

- Access the General Settings in Carlson Configure
- Set the General Settings to your needs

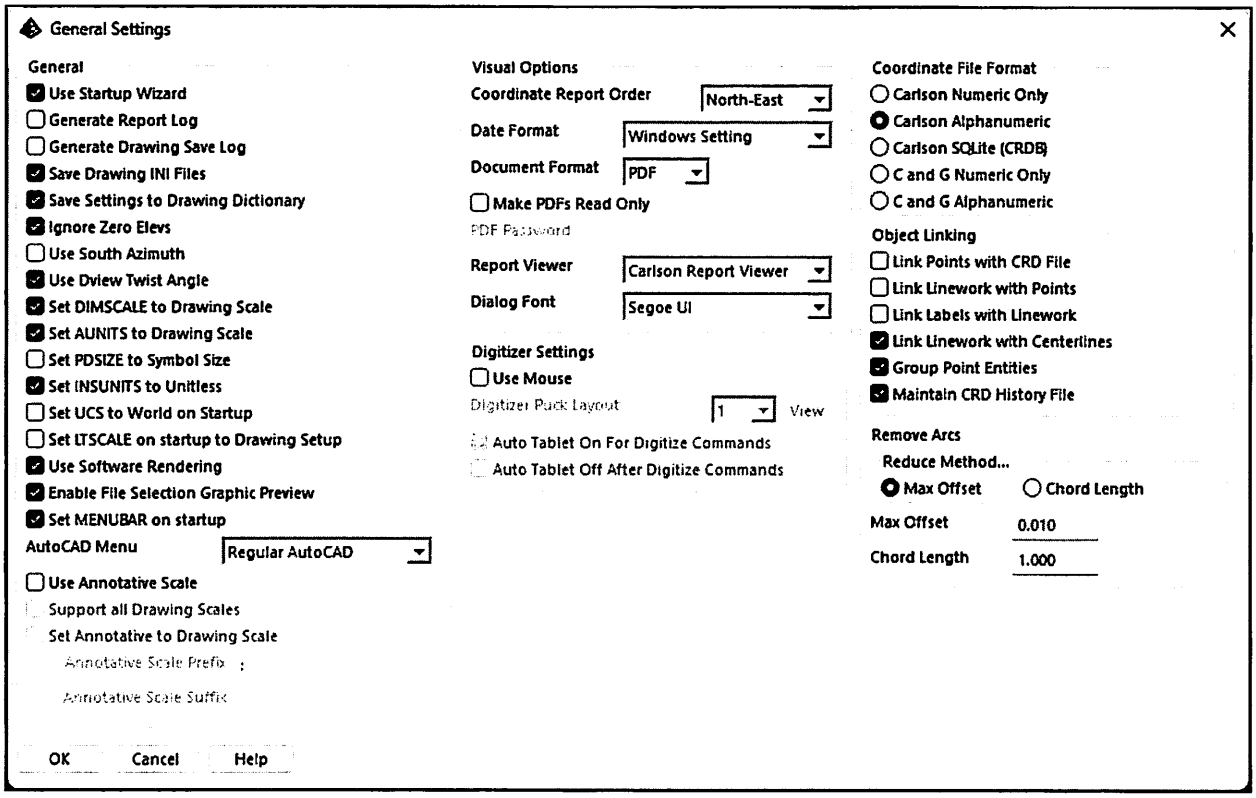
General Settings

Many Settings control the behavior of Carlson drawings. It is beneficial to have certain Settings apply to all drawings, while others will inevitably need to easily vary from drawing to drawing. The General Settings are a collection of generic settings that apply to all new drawings.

General Settings Categories

The General Settings dialog box is divided into sections:

- General
- Coordinate File Format
- Object Linking
- Remove Arcs
- Digitizer Settings



General

Many of these settings are quite of a general CAD nature and self-explanatory to anyone with a basic CAD background, and so will not be discussed in this text. However, the option to Use Startup Wizard is specific to Carlson, and recommended by the authors. With this option selected, the *Startup Wizard* will be presented every time you start a new drawing. When you first start the software, the *Startup Wizard* will be the first thing you see.

When the software is already running, if you use the *New* drawing icon in the standard toolbar, the default drawing template (.dwt file) will automatically be used for the new drawing. If you use the file pull-down menu, you will be prompted to select a template (.dwt file) to base the new drawing on, before the *Startup Wizard* appears.

Save Settings to Drawing Dictionary is an option that allows many settings that you use to control the behavior of the program, and/or the appearance of objects created by the program, to be saved with the drawing. With this option engaged, when you give your drawing to another person using Carlson software, the settings that you established will go with the drawing and show up in the other person's settings dialog boxes.

The last option in the General section is the setting for the AutoCAD Menu. Use this to set your choice of which AutoCAD menu will be displayed if the AutoCAD Icon is selected in the Carlson Menus toolbar, Carlson Menus pick on the Settings pull-down menu, or the Modules panel in the Setup ribbon.

Coordinate File Format

This setting controls what type of database is used to store Carlson point data. The most common is Carlson Alphanumeric. It has no size limitation, and can accept alphanumeric point numbers, such as A1.

The CRDB file format is similar in function to the Alphanumeric format with the addition of allowing GIS attribute information to be attached to individual points as well as the ability to *Lock* points available in the Points menu.

Object Linking

The *Object Linking* options control if and how entities in the drawing are linked to external data files.

Selecting *Link Points with CRD File* means that if the blocks in the drawing that represent the records in the external point database are edited, moved, or erased, the CRD file will be automatically updated. This can be beneficial at times, but generally can be more dangerous as well, due to the ease in which inadvertent edits to the database can occur.

Selecting the *Link Linework with Points* option means that if lines are drawn using point numbers and those points are moved or edited, the linework will also change. Again, this can be a beneficial option to choose in some environments, but can be problematic in others.

Selecting *Link Labels with Linework* means that as labeled linework in the drawing is edited, the labels are automatically updated. These are sometimes known as dynamic labels. Some users prefer this use of labels, some prefer they do not update with changes.

Selecting *Link Linework with Centerlines* means that if the polylines that represent externally stored centerline data is changed, the external files will be automatically updated. The same considerations noted above apply to this option as well.

Group Point Entities in not so much a linking of drawing to data, like some of the others, but simply refers to the CAD Grouping of the 3 entities used to represent points in the drawing. It is generally desirable to have these behave as a Group.

The *Maintain a CRD History File* option creates and maintains a file with all changes made to the current coordinate file, with the dates, so the point database can be set back to an earlier version if it is erroneously edited. It is generally a good option to choose.

Remove Arcs

This setting controls when and how Carlson Software generates chords instead of arcs.

Digitizer Settings

These settings control the hardware setup for commands in Carlson Software that employ digitizing actions.

Exercise: General Settings

In this exercise you view the Carlson General Settings and set them to your preferences.

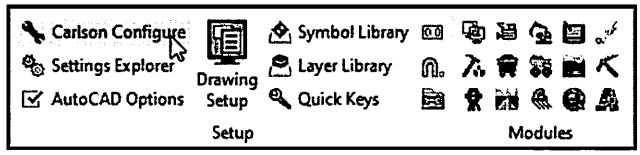
You do the following:

- Access Carlson Configure
- Access General Settings
- Set General Settings options

2.2.1 Working with General Settings

1. Continue working in the drawing from the previous exercise.

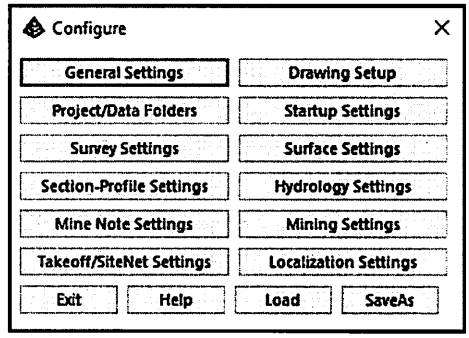
2. Select **Ribbon: Setup ⇒ Setup ⇒ Carlson Configure.**



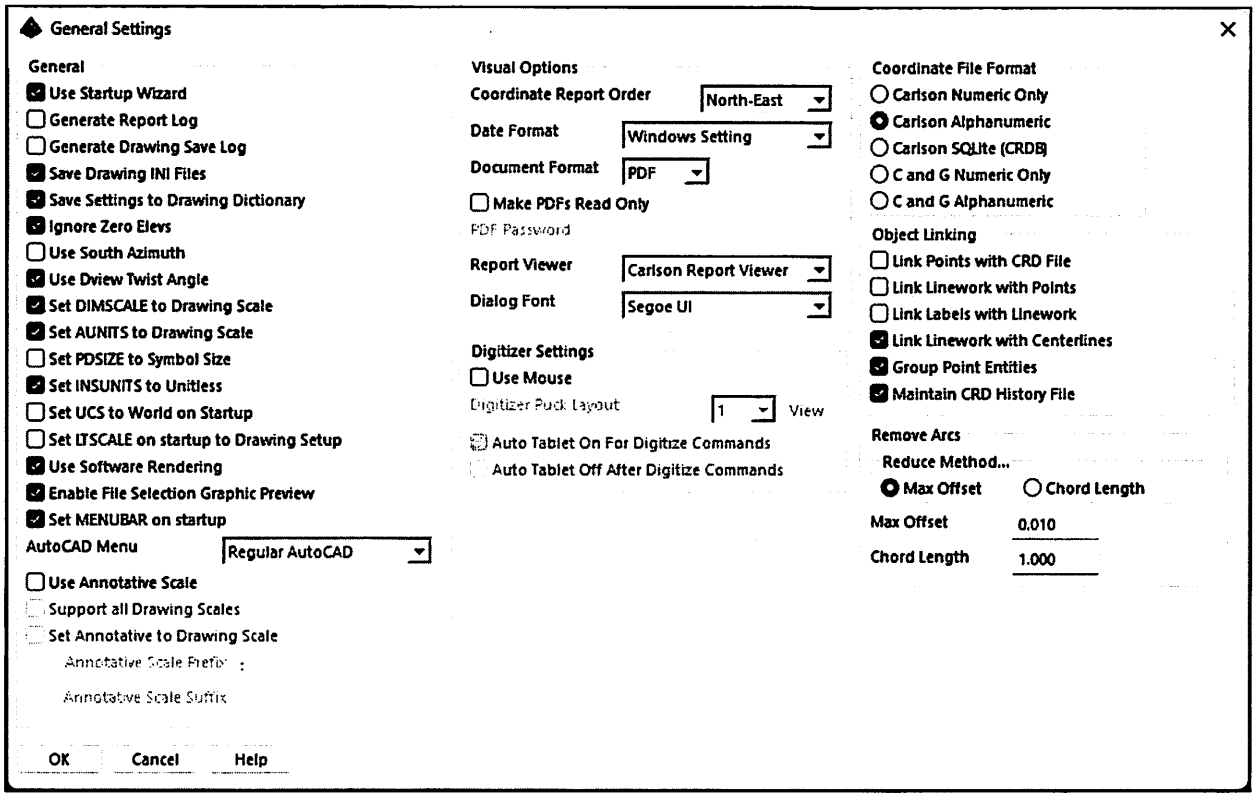
Alternatively, from the pull-down menu:
Select **Settings ⇒ Carlson Configure.**

The *Configure* dialog box is opened.

3. Click **<<General Settings>>**.



The *General Settings* dialog box is opened.



4. Confirm the option to **Use Startup Wizard** is enabled.

5. Review the other settings in the *General Settings* dialog box and confirm they are set to match the graphic above.
   (Note: This dialog box will look slightly different if you are using the IntelliCAD version)

6. Click **<<OK>>** to save the changes.

7. Back in the *Configure* dialog box, click **<<Exit >>**.

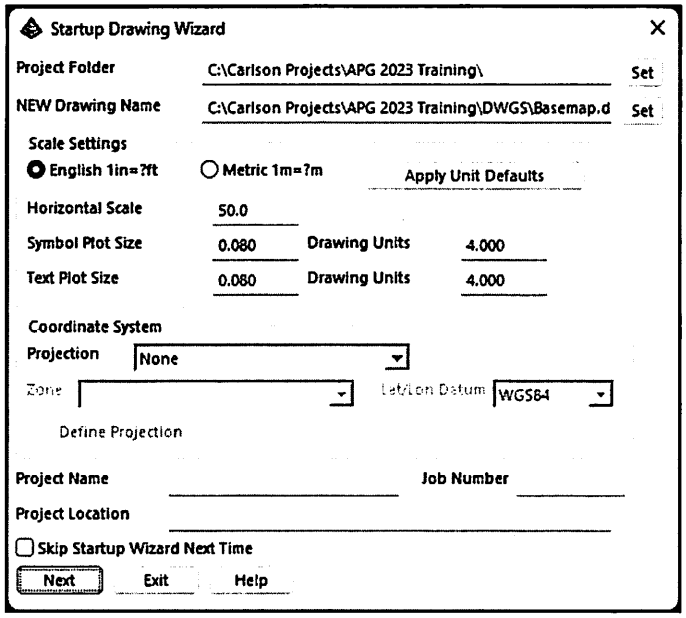
Lesson Review

In this lesson, the General Settings in Carlson Configure were discussed and set for a typical working office environment.

2.3 Lesson: Creating a New Drawing

Introduction

In this lesson, we cover the procedure to start up a new Project in Carlson Software and a new Drawing in that Project.



Key Concepts

Concepts and key terms covered in this lesson are:

- Startup Drawing Wizard
- Scale Settings
- Data Path
- CRD File

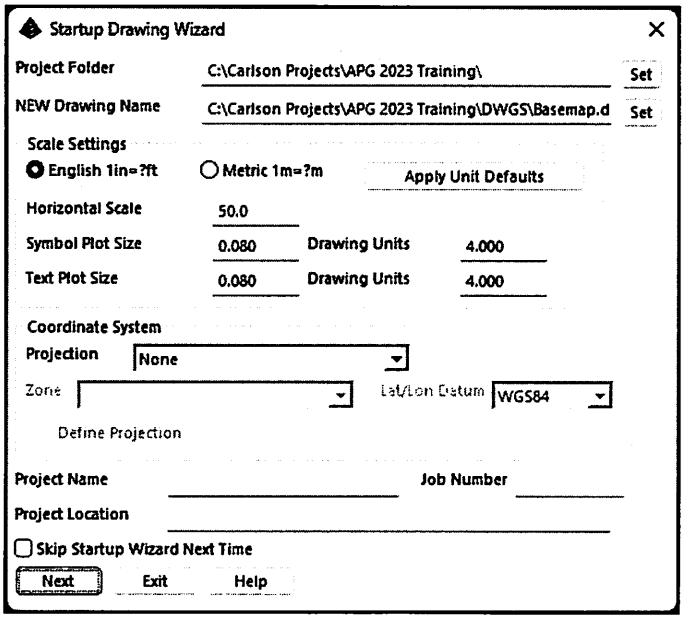
Objectives

After completing this chapter, you will be able to:

- Navigate the Two Panels of the Drawing Startup Wizard

Startup Drawing Wizard

The *Startup Drawing Wizard* walks you through the process of creating a new project, or selecting an existing one, and setting up a new drawing.

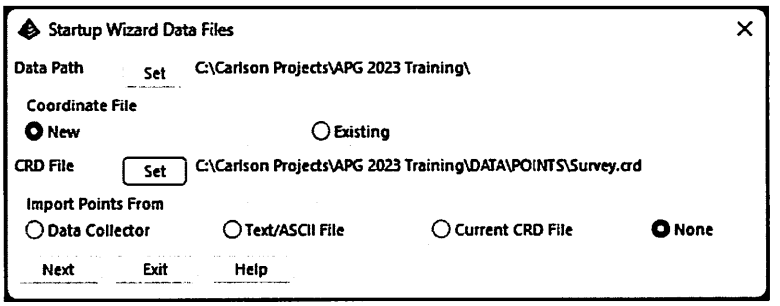


You can select an existing project folder or create a new one. If you choose to use either the *Drawing Folder* or a *Fixed Folder* options to store your project data, you will not see the prompt for a *Project Folder* in the *Startup Drawing Wizard.*

Next, you will name and save the new drawing. You are allowed to save the drawing in any location you wish. Carlson Software does not have any restrictions on the locations drawings are saved. When using the CSW folder assignments as described in a previous lesson the new drawing location defaults to the DWGS folder inside the newly created project folder.

Then, set the units to English (also known as Imperial) or Metric. Enter the intended plot scale, and set the default text and symbol heights. In English units these will be plotted inches. In Metric units these will be plotted centimeters. The program multiplies the scale times the symbol and text plot sizes and sets the drawing units for these two items.

You can assign a *Coordinate System* to the new drawing here in the *Startup Drawing Wizard.*



The second dialog box in the wizard is called *Startup Wizard Data Files.* It essentially is prompting for two bits of information. The first is the default location for data files to be used with this drawing. If you are using the project method for data storage, the data path will default to the project folder specified in the previous dialog box. Any specific file types that

have been assigned to specific folders will still default to those folders. This setting is merely a safety net for any files that have not been so specified.

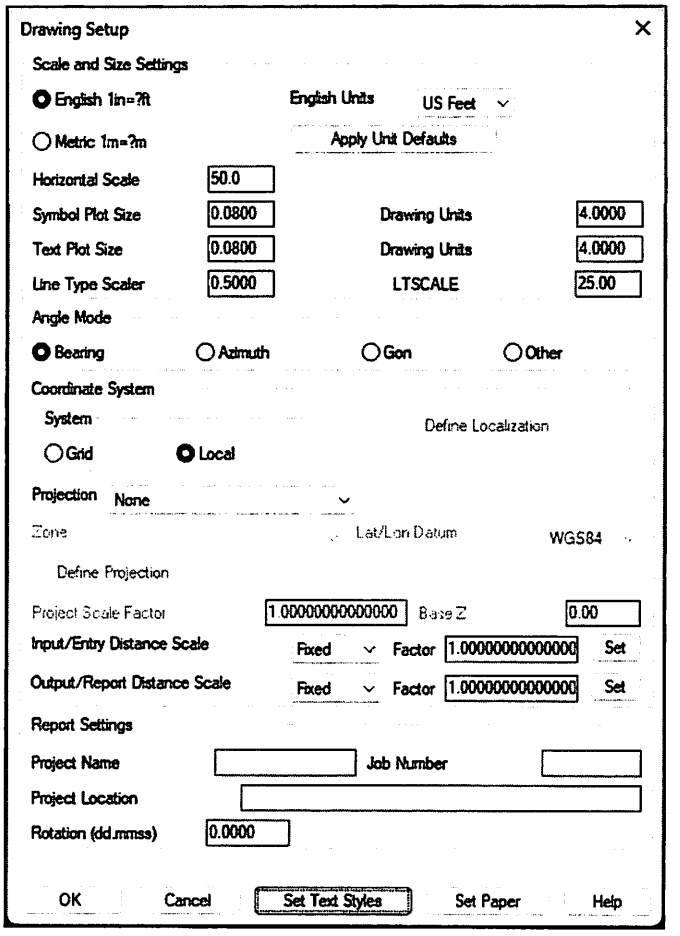
The second item designated in this dialog box is the name and location for the initial coordinate file, or CRD, to be used with this drawing. In Carlson, you are working in a drawing file at all times, but the external coordinate file, the .CRD file, that is currently set for read and write is considered the primary external data file associated with the open drawing. For this reason, the name of the current CRD is displayed in the title bar of the program.

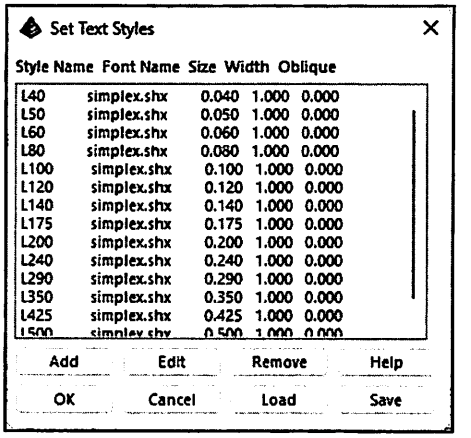
This dialog box will default to a new coordinate file, as opposed to an existing coordinate file, and will name the file the same as the drawing file name. Again, if using the CSW file assignments as described in a previous lesson, the new coordinate file will be placed inside the points folder within the project folder. If you do not want to use the drawing name for the coordinate file, simply click the set button next to CRD file and enter a different name for the coordinate file.

The last setting in this dialog box is to specify where to import points from for this coordinate file. Coordinate data can be imported at this time from a *Data Collector*, from an *ASCII* text file, or from a *Current CRD File*. However, all of these options can also be executed once the new drawing is created, so the choice of *None* will start the new drawing and allow the import of the coordinate data to be postponed until you are ready.

Automatically Create Text Styles

In Carlson Software there is an option to automatically create a set of named text styles with heights set appropriately for the current Drawing Scale. Go to *Settings ⇒ Drawing Setup*.





In the *Drawing Setup* dialog box, pick the *<<Set Text Styles>>* button at the bottom. In the *Set Text Styles* dialog box you will see a list of Text Styles with their properties, including font, size (height), width, and oblique angle. The size is the height you want the text to appear on paper when it is plotted, in inches for Imperial (English) drawings, or centimeters for Metric drawings.

In the *Set Text Styles* dialog box, there are buttons at the bottom to Add new Styles, Edit or Remove existing Styles, and to Save the current list of Styles with their definitions to an external file (.FNT file), or Load an existing set of Styles that has been saved as an .FNT file. These Save and Load functions allow sets of Styles to be easily shared between users.

Selecting the Add button opens the Text Style dialog, where the Style name, Font name, (selected from a drop list), Text Size Scaler, (which is the desired plotted height, as discussed above), Width Factor and Oblique Angle are set for the new Style.

Selecting the Edit button opens the same dialog box for an existing Style so that its parameters can be edited.

Once the Styles you want are listed and set to your desired specifications, Click *<<OK>>* to create the Styles. If the Drawing Scale changes, simply access the Set Text Styles dialog again and click *<<OK>>* to redefine the Styles with new heights.

Exercise: Starting a New Drawing

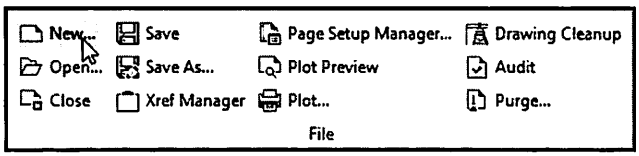
In this exercise you start a new Drawing and a new Project to organize the data work in.

You do the following:

- Create a new Project
- Start a new Drawing
- Assign a Horizontal Scale
- Establish a new Coordinate file for Point data

2.3.1 Starting Up a New Drawing

1. Select **Ribbon: File ⇒ FIle ⇒ New.**



Alternatively, from the pull-down menu:
Select **File ⇒ New.**

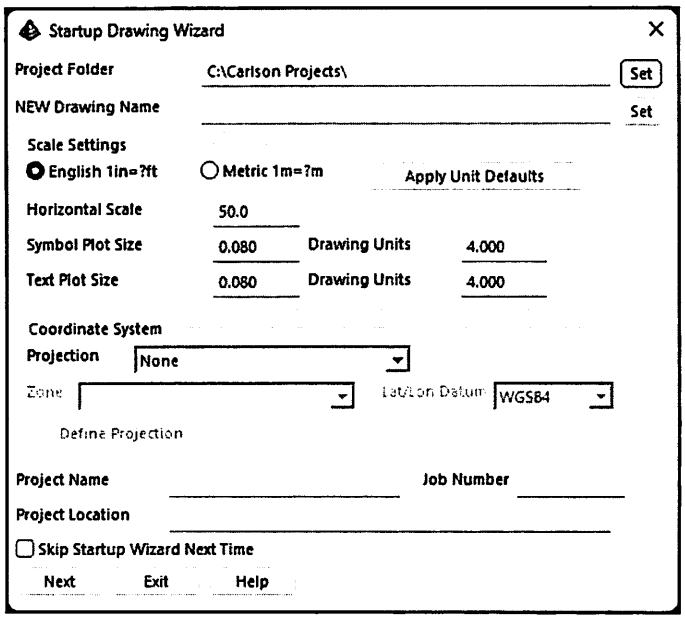
2. Select the drawing template **carlson23.dwt** and click **<<Open>>.**

Note: Depending on the version of Carlson you have installed; the default template may have a different name. (ie. Surv.dwt or Carlson.dwt). In any case, the extension to the file name will be .DWT. A discussion on employing a user defined template appears later in this book.

In the *Startup Drawing Wizard*, since you chose to use projects to organize your data, you will be asked to set the *Project Folder* for the new drawing.

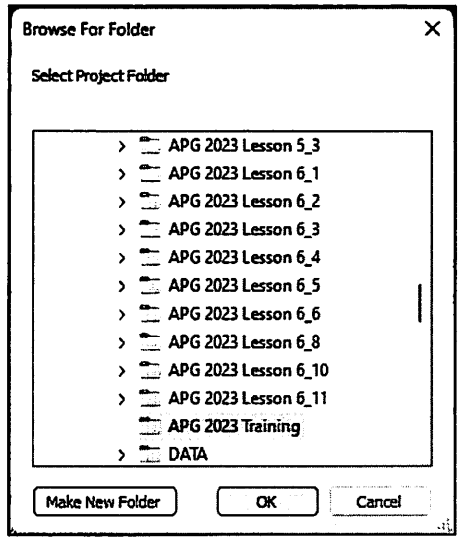
3. Click **<<Set>>** next to **Project Folder.**

Note: if you choose to use either the *Drawing Folder* or a *Fixed Folder* options to store your project data, you will not see the prompt for a project folder in the startup wizard.



This opens the *Select Project Folder* dialog box. Here, you can either select an existing project folder or create a new one.

4. Confirm the folder **C:\Carlson Projects** is selected.



This project folder is often set to a shared network location. For training purposes we are setting it local on the C drive.

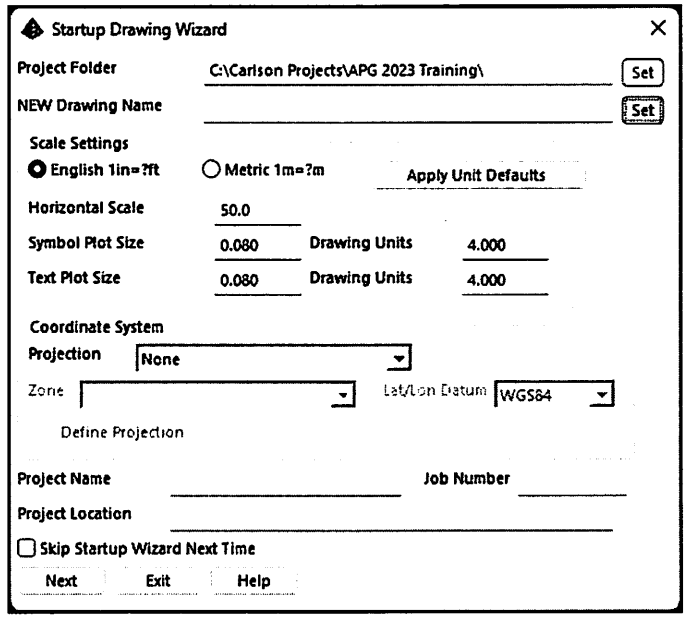
5. Click **<<Make New Folder>>**.

6. Enter **APG 2023 Training** for the name of the new directory.

This is the name of the new project you are creating.

7. Click **<<OK>>**.

8. Back in the *Startup Drawing Wizard*, click **<<Set>>** next to **NEW Drawing Name**.

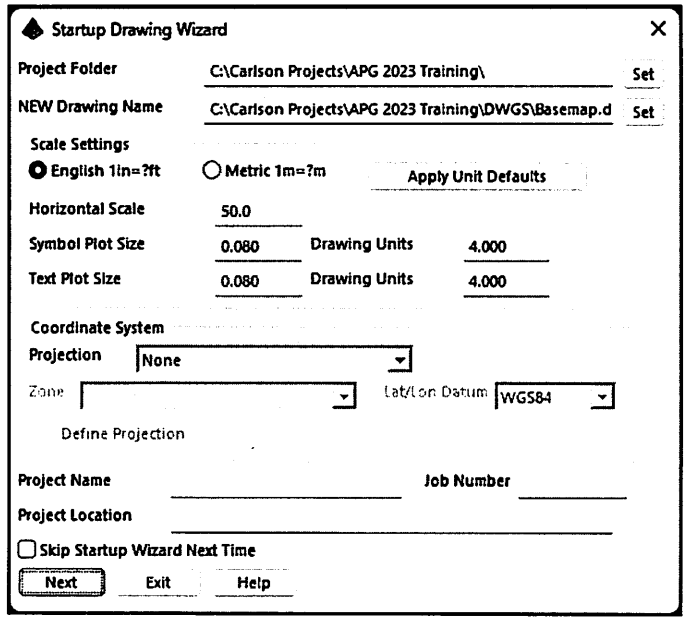


The new drawing location defaults to the DWGS folder inside the newly created project folder. This is because you selected the CSW folder assignments in a previous lesson. You are allowed to save the drawing in any location you wish. Carlson software does not have any restrictions on the locations drawings are saved. However, if you are using the Project method for organization of your work, it is beneficial to keep the drawings in the DWG folder in the Project.

9. Name the drawing **Basemap** and click **<<Open>>**.

10. Back in the *Startup Drawing Wizard*, confirm the units are set to **English**.

11. Confirm the **Horizontal Scale** is set to **50**.



The *Horizontal Scale* should be set to what scale you initially think the drawing will be plotted at. If that changes, you can always come back and adjust it.

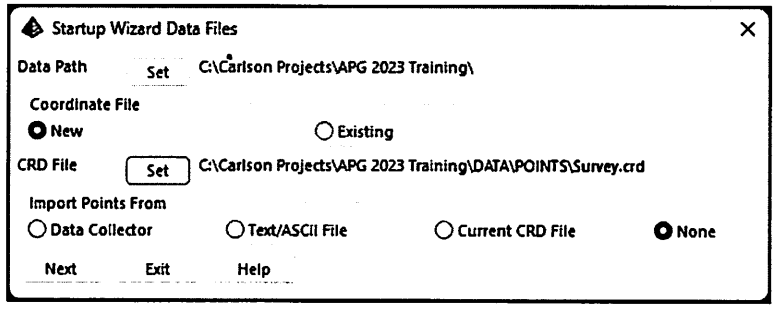
The *Symbol Plot Size* and *Text Plot Size* should be set to what size you want those items plotted at, on paper, in inches for English (Imperial) Units, in centimeters for Metric. Carlson Software multiplies those values by the Horizontal Scale to derive the actual size in drawing units for those items, in feet for English (Imperial) drawings and Meters for Metric drawings.

You also have the option to assign a *Projection* and *Zone* for your new drawing here.

12. Click **<<Next>>**.

This opens the *Startup Wizard Data Files* dialog box.

13. Confirm the **Data Path** is set to the path shown.



You are using the project method for data storage, so the data path will default to the project folder specified in the previous dialog box. Any specific file types that have been assigned to specific folders will still default to those folders.

14. Confirm the **Coordinate File** is set to **New**.

15. Click **<<Set>>** next to **CRD File**.

By default the CRD file is named the same as the drawing file. However, you do not need to leave it this way. You can set the name of the new CRD file to be something that adheres to a company standard or one that seems more intuitive to your own use.

16. Name the new *CRD File* **Survey**.

17. Confirm the **Import Points From** option is set to **None**.

Coordinate data can be imported from a *Data Collector*, from an *ASCII text file*, or from the *Current CRD File* as part of the drawing setup process when the wizard completes. The choice of *None* will start the new drawing and allow the import of the coordinate data to be done at a later time.

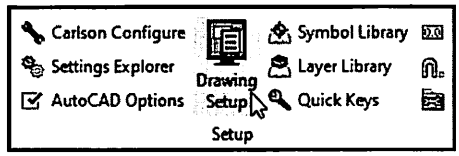
18. Click **<<Next>>** to complete the *Startup Drawing Wizard*.

A new drawing and a new project, containing a blank CRD file, have now been created.

2.3.2 Defining Text Styles

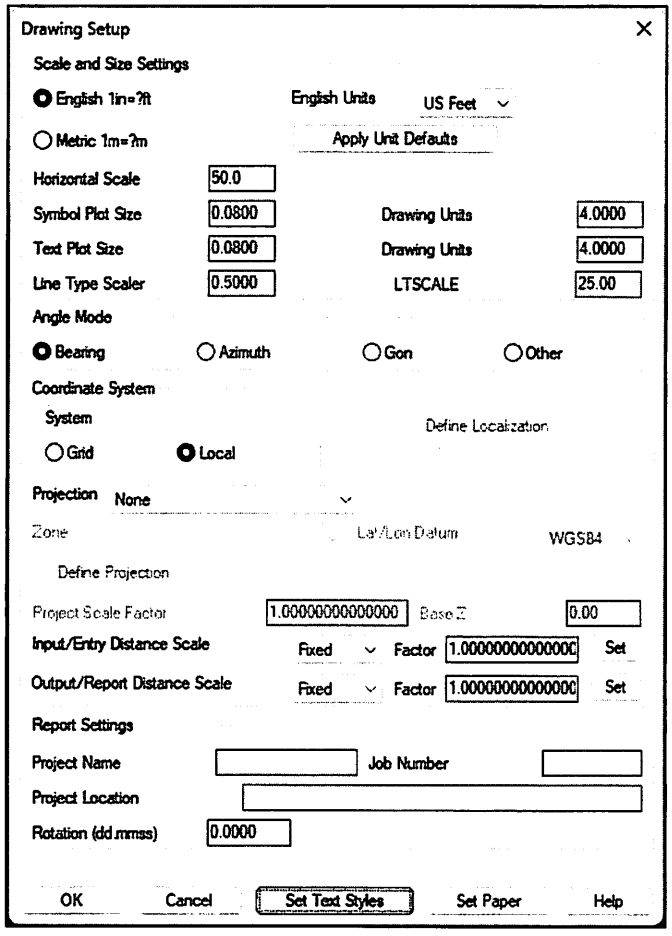
Now you will define a set of Text Styles to be created by the program with the correct text heights for the current drawing scale.

1. Select **Ribbon: Setup ⇒ Setup ⇒ Drawing Setup.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Drawing Setup.**

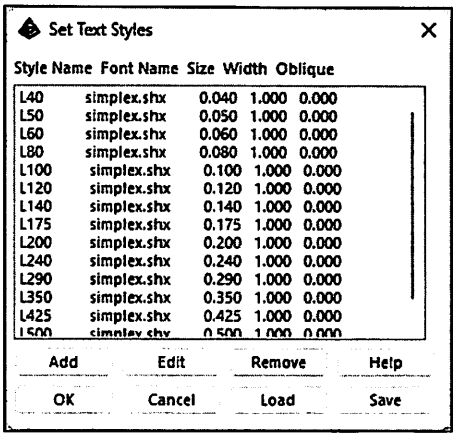
The *Drawing Setup* dialog box opens.



2. Confirm the **Horizontal Scale** is set to **1"=50'.**

3. Click **<<Set Text Styles>>**

This opens the Set *Text Styles dialog* box.

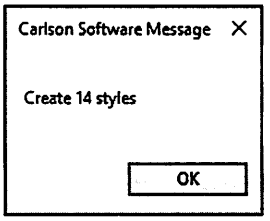


A set of Text Styles is displayed, based on the traditional Leroy template names and text heights, L40 through L500. They all use the Simplex (or IC-Simplex for IntelliCAD) font file, and all have a Width Factor of 1.0 and an Oblique Angle of 0.

The parameters of any listed Text Style can be edited by selecting it and clicking **<<Edit>>.** New Styles can be created by clicking **<<Add>>.** The entire list of Styles can be saved as an external .FNT file by clicking **<<Save>>.** Saved .FNT Style sets can be loaded by clicking **<<Load>>.**

4. Click **<<OK>>** to create the default list of *Text Styles*.

You are shown the number of styles created.



5. Click **<<OK>>.**

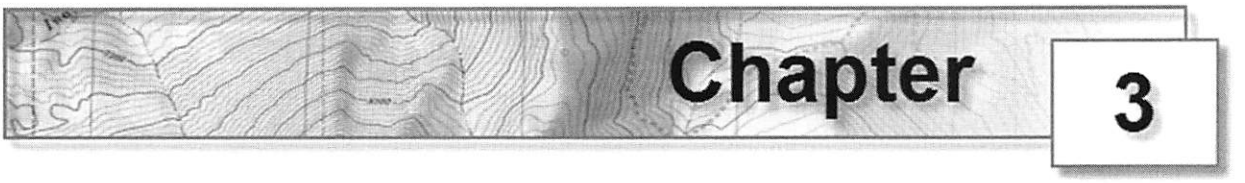
6. Back in the *Drawing Set Up* dialog box, click **<<OK>>.**

Lesson Review

In this lesson we started up a new Project, and then a new drawing assigned to that Project.

Chapter Review

In this chapter, you learned how to set up the storage of external data files, set various *General Settings* for new drawings, and start up a new *Project* and *Drawing*.



3 - Working with Points

Introduction

In this chapter, you are introduced to the theory and practice of working with Points and Point Data in Carlson Software.

These concepts are covered in the following lessons.

Lesson: Introduction to Point Data

In this lesson, you learn what Point Data is, common sources of Point Data, and how Carlson Software works with point Data.

Lesson: Importing an ASCII/Text File

In this lesson, you learn how to populate the Point Database by Importing a Text/ASCII File.

Lesson: Point Defaults

In this lesson, you learn about how Point Defaults control the behavior and appearance of Points in the drawing.

Lesson: Draw Locate Points

In this lesson, you learn how to use the Draw-Locate command to create Carlson Point blocks in a drawing to represent the records in the external Point Database.

Lesson: Editing Point Blocks

In this lesson, you learn how to change the appearance of Point Blocks in the drawing using Point Editing tools.

Lesson: Editing Point Data

In this lesson, you learn how to Edit the actual Point Data in the External Database.

Lesson: Erasing Points

In this lesson, you learn how to Remove Point Blocks from the drawing with or without erasing them from the external database.

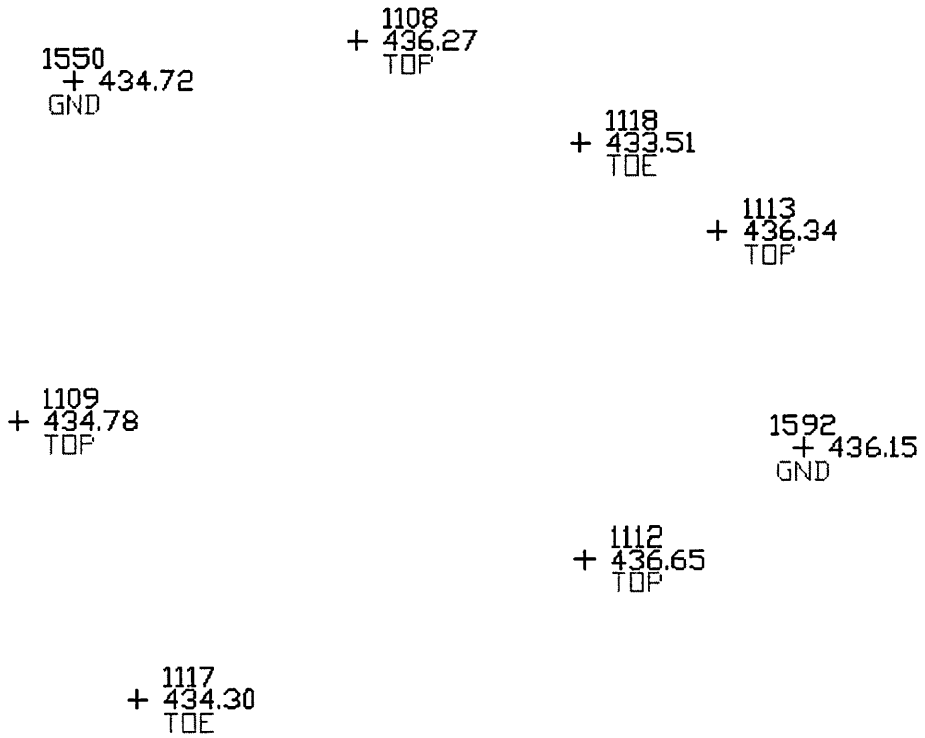
Lesson: Using Point Groups

In this lesson, you learn how to create logical groups of Points for Editing, drawing, and Uploading.

3.1 Lesson: Introduction to Point Data

Introduction

In this lesson you learn how *Carlson Software* works with point data. Point data, also known as coordinate data, is most often associated with locations identified through field surveying, but can also be used for locations defined in office procedures, used for proposed design data, or created for use for field stakeout tasks.



Key Concepts

Concepts and key terms covered in this lesson are:

- Point Data
- External Point Database
- Point Blocks

Objectives

After completing this lesson, you will be able to:

- Describe what point data is
- Explain how Carlson Software stores point data

What is Point Data?

Point Data is coordinate data. It is typically generated through the field survey data collection process, but it can also be manually generated in the office. It can be used for civil design applications, as well as survey applications. More recently, stationary digital scanners, mobile digital scanners and airborne LiDAR scanning can all generate massive amounts of data, which is fundamentally just point data as well, just in large datasets. Carlson Software can work with any point data from any source.

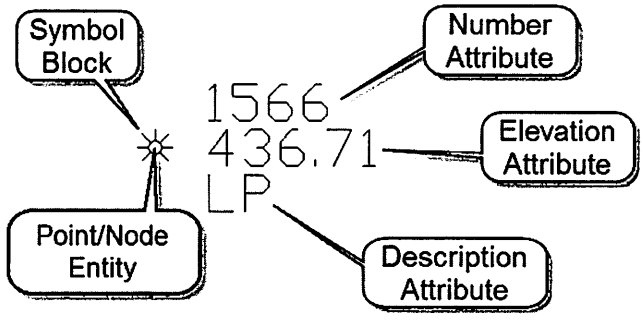
How does Carlson Software work with Point Data?

Carlson software uses an external proprietary database to store point data. These coordinate files are named by the end user, though all share a .CRD file extension. Only one .CRD file can be active and current at any given time. However, the end user can change which coordinate file is currently being used for read and write functions at any time. This is done through the use of the Set Coordinate File command.

Though caution must be observed when using multiple coordinate files on a single project, the benefits can be significant. For instance, the original existing conditions field survey data can be stored in one .CRD file, while survey control can be stored in another. As Built surveys can be stored in their own files, stake out points in another, and proposed design point data generated in the office in yet another, thereby eliminating potential confusion, and minimizing the danger of compromising important data. The implementation of Carlson coordinate files varies among end users with different workplace needs and situations, and that is ultimately a great advantage of the program.

Point Blocks

Within the drawing file, *Carlson Software* uses a standard CAD block to represent point data. To be more precise, three objects are actually used for each point; a point block with attributes, symbol block, and a standard CAD point entity or node. These are typically created as a group, but that grouping can be turned off if desired.



It is important to remember that the dynamic location of the point itself with the coordinate file (CRD) is linked to either the point block or point entity (node) and not the symbol block. There is an option to disable the creation of the standard CAD point entity (node).

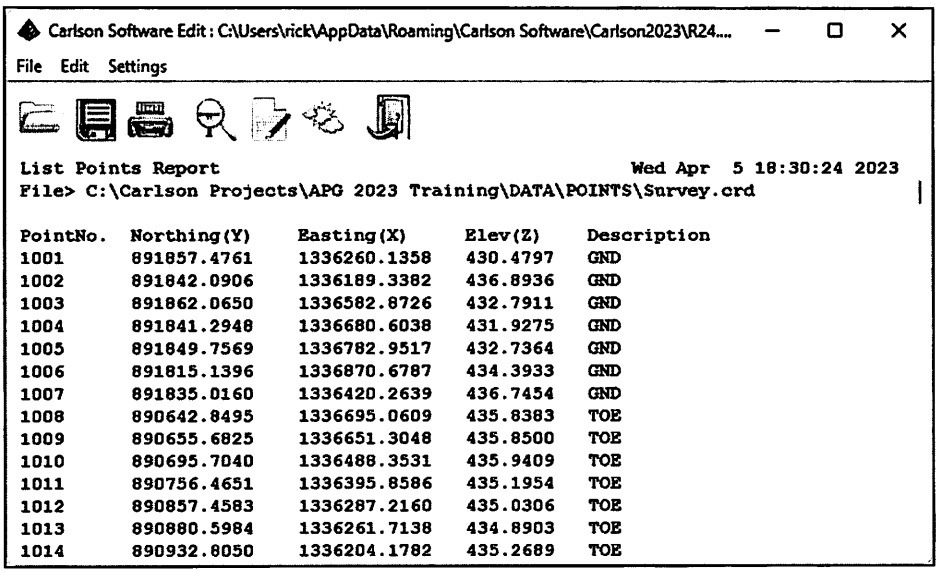
Lesson Review

In this lesson, you learned what point data is and how *Carlson Software* works with it.

3.2 Lesson: Importing a Text/ASCII File

Introduction

In this lesson, we will focus on populating an external coordinate file with point data by importing a standard Text/ASCII file. This is a very common vehicle to store and transfer point data between applications.



Key Concepts

Concepts and key terms covered in this lesson are:

- List Points
- Text/ASCII Files
- Importing Points

Objectives

After completing this lesson, you will be able to:

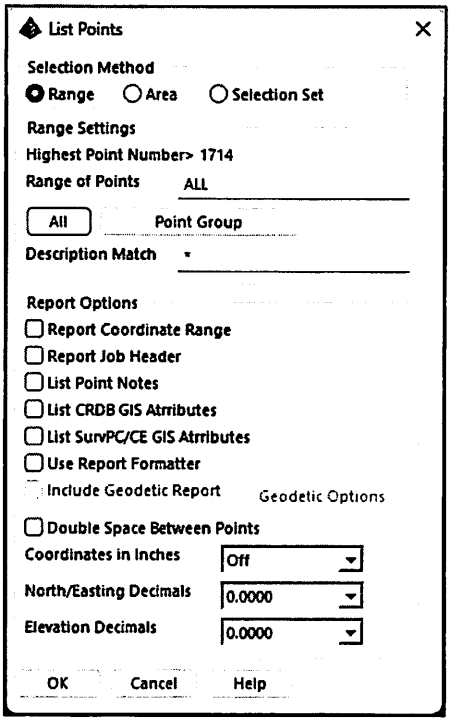
- Explain what a Text/ASCII File is
- Describe different options for importing points
- Import point data from a Text/ASCII File
- List Imported Points

Text/ASCII Files

One common method of populating the Point Database is by Importing a Text/ASCII File. This is a very common vehicle to store and transfer point data between applications. Each line of the text file contains the data for a single point. The most common format used contains a point number, northing (or Y), Easting (or X), elevation, and description for each point. These attributes or fields are often separated by commas but can also be separated by spaces, tabs, or other delimiters.

Listing Points

The List Points command presents a report of points in an external .CRD coordinate file. The List Points dialog box presents options for which points are to be listed, and how they are to be listed. The results are displayed in the standard Carlson report screen, or you can choose to employ the Report Formatter to select which data is reported and in what way and in what format.



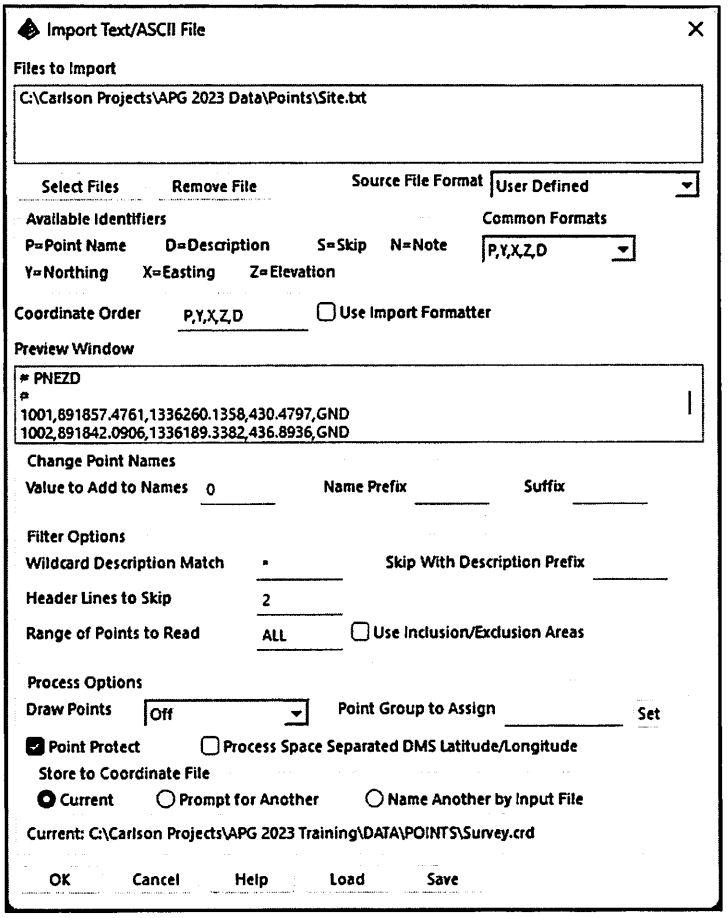
The List Points dialog initially defaults to using the Range to specify which point to include in the report, and the highest number in the current coordinate file is shown, and the Range of Points is set to all of the points in the file. In subsequent use of the List Points feature, you can alternatively choose to select the Range of points to include in the list by specifying a different Range of Point Numbers, or selecting a Point Group. You can click the All button to reset the Range of Points to all the points in the coordinate file. You can also use an Area in the drawing to select points, or you can use a Selection Set.

The Report Options can be used to customize the report, which can be generated in the Standard Carlson Report Viewer, or you use the Report Formatter to further customize the report.

Importing Points from a Text/ASCII File

The most common and traditional method used to store point data is a simple text file. This file is interchangeably referred to as a Text/ASCII file, a point file, an ASCII file, an ASCII text file, or even an ASCII text point file. They are essentially synonymous.

The file format can vary, but almost always, each line of the file stores the data for a single point. The components of the point data can be displayed in different order, with different delimiters between fields, but the most common is a P,N,E,Z D format. This stands for Point number, Northing, Easting, Elevation (Z) and Description. Carlson refers to this format as P,Y,X,Z,D, as Y is synonymous with Northing, and X is synonymous with Easting. The fields are comma delimited.



Wildcard Description Match

An * Wildcard match indicates that all point descriptions in the Text/ASCII file will be used. Otherwise, a specific matching can be applied so that only certain points are read in.

Header Lines

Some Text/ASCII files have one or several lines at the beginning describing the file or the source or the format or other metadata, and these lines must be ignored by the Import function or they will cause an error. This option tells the Import function if any lines need to be ignored at the top of the file, also known as the Header.

Point Group to Assign

This will automatically assign all the points Imported in this execution of the command to a specific Point Group. This can be helpful if you want them to be easily distinguished or

isolated at a later time. A typical application of this is to assign them to a Point Group with the date of the Import as a name.

Point Name Prefix

This option allows you to create a point group using a Point Name Prefix as a filter. Point Names are Alpha Numeric Point Numbers. A Point Name Prefix can be up to nine characters long and can be both Alpha and Numeric. For example, if point names (or Numbers) are coded with a prefix of ROAD followed by the number ie. ROAD1001, and a Point Name Prefix is set to 4, a point group named ROAD would be created containing all points prefixed with ROAD.

Range of Points to Read

This option allows you to specify a specific range of point numbers to be read in and then written to the .CRD file.

Draw Points

This setting controls if the points are generated in the drawing as point blocks after they are Imported into the .CRD coordinate file. When set to Off, they are not. When set to Draw-Locate, they are, using the Draw-Locate command and settings. When set to Field to Finish, they also are generated in the drawing, but in this case using the current Field to Finish settings.

Point Protect

This option checks to see if the point numbers being Imported are already present in the current .CRD. If Point Protect is selected, and point numbers being Imported are already in the .CRD, you are prompted with options of how to resolve the conflicts.

Exercise: Importing a Text/ASCII File

In this exercise you Import a Text/ASCII File of Point data. The Point data is written to a Carlson Software proprietary point database, known as a .CRD file.

You do the following:

- Adjust Import Settings
- Import the File

3.2.1 Importing a Text/ASCII File

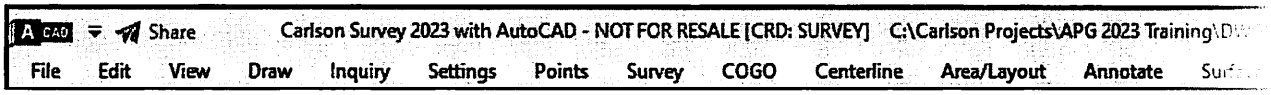
If you have not already downloaded and installed the dataset, instructions can be found on page vi.

1. Continue working in the drawing **Basemap.dwg,** created in the previous chapter.

If you have not completed the previous lessons:
Open *3_2.dwg* from the project folder *APG 2023 Lesson 3_2.*

2. Notice at the top of the screen that the current coordinate file is set to **CRD: SURVEY**.

Note: If you are in 3_2.dwg, the coordinate file you are using is C:\Carlson Projects\APG 2023 Lesson 3_2\DATA\POINTS\Survey.crd.



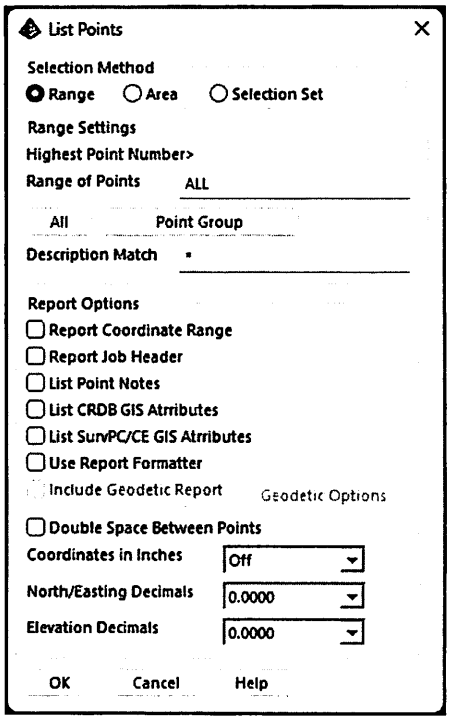
3. Select
Ribbon: Points ⇒
Points ⇒ List Points.

Alternatively, from the pull-down menu:
Select **Points ⇒ List Points.**

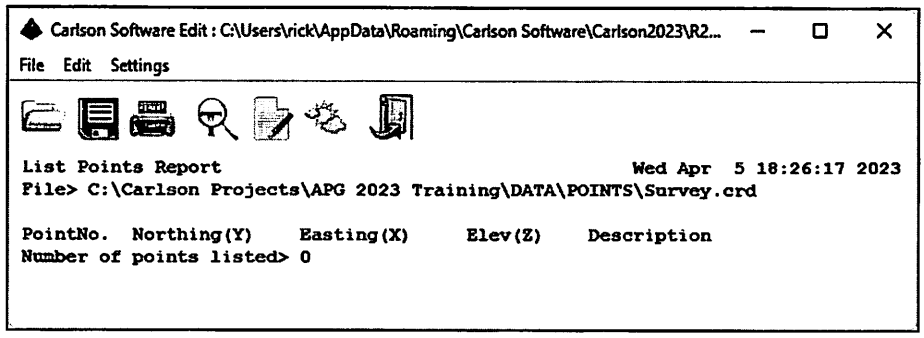
The *List Points* dialog box is opened.

4. Click **<<All>>**.

5. Click **<<OK>>**.



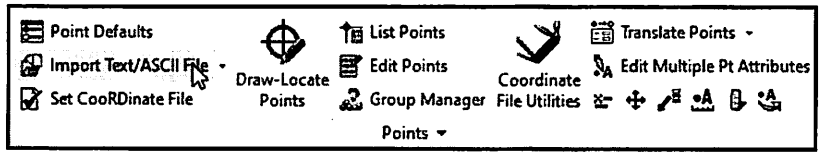
The report dialog box is displayed.


Carlson Software Edit : C:\Users\rick\AppData\Roaming\Carlson Software\Carlson2023\R2...
File Edit Settings
List Points Report Wed Apr 5 18:26:17 2023
File> C:\Carlson Projects\APG 2023 Training\DATA\POINTS\Survey.crd
PointNo. Northing(Y) Easting(X) Elev(Z) Description
Number of points listed> 0

6. Notice there is no point data in the current CRD file.

7. Close the report dialog box.

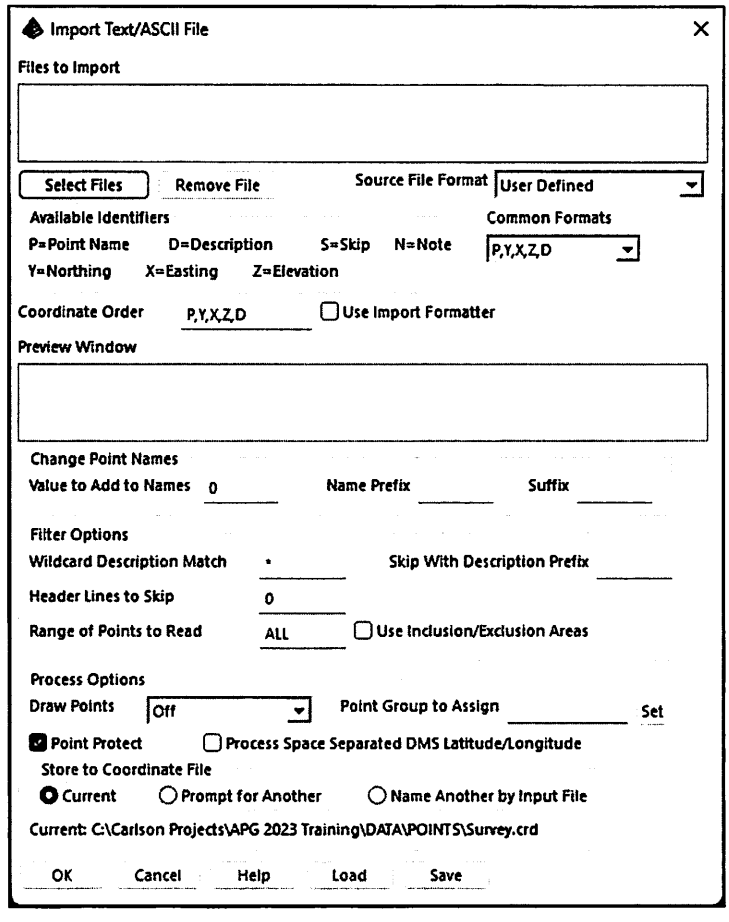
8. Select **Ribbon: Points ⇒ Points ⇒ Import Text/ASCII File.**



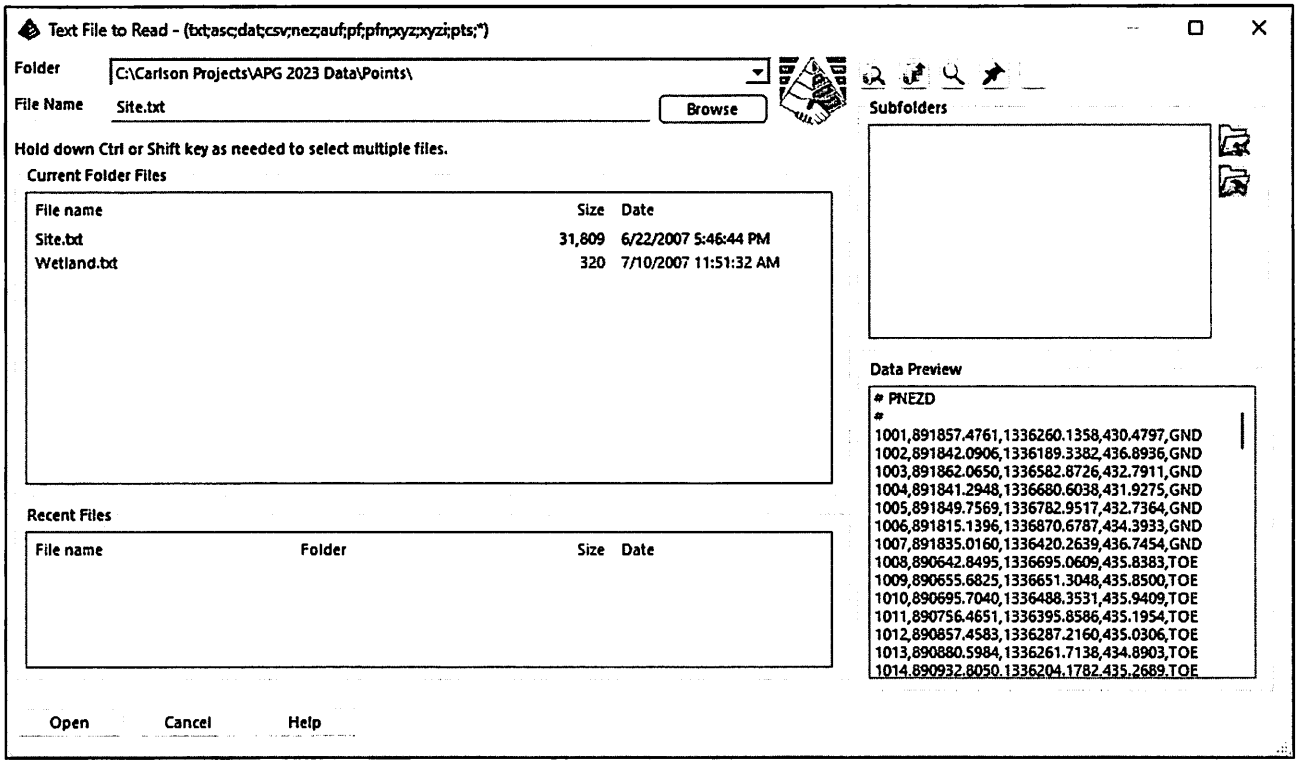
Alternatively, from the pull-down menu:
Select **Points ⇒ Import Text/ASCII File.**

9. Confirm the **Source File Format** is set to **User Defined**.

10. Click **<<Select Files>>**.



This opens the *Text File to Read* dialog box.



11. Browse and select the file: **C:\Carlson Projects\APG 2023 Data\Points\Site.txt**

You can review the contents of the selected text file in the *Data Preview* section of the dialog box.

12. Click **<<Open>>** to return to the *Import Text/ASCII File* dialog box.

In the *Preview Window* you can see the text file is comma delimited and the format is PNEZD.

13. In **Common Formats** confirm **P,Y,X,Z,D** is selected to match the format of the text file.

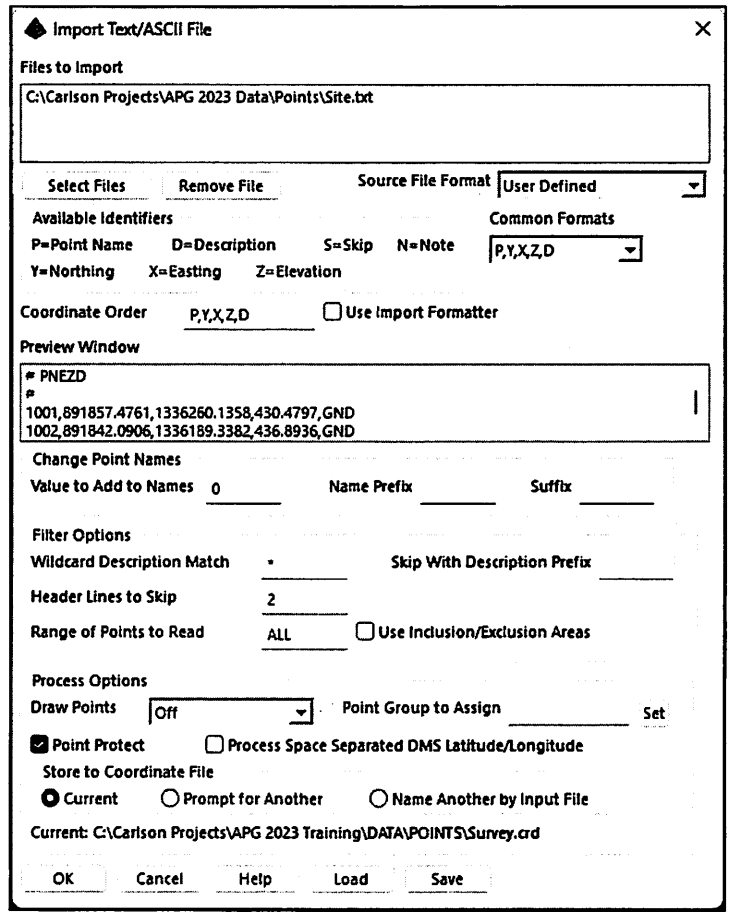
If there is not a *Common Format* available that matches your point file you can use the *Coordinate Order* field to define a custom format that maps the point data correctly.

In the *Preview Window* notice the first two lines of the point file are header information rather than point data.

14. Enter **2** for the **Header Lines to Skip** option.

15. Confirm **Draw Points** is set to **Off**.

16. Confirm the **Store to Coordinate File** option is set to **Current**



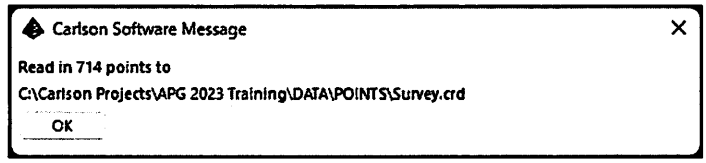
17. Confirm the current CRD file is set to: **C:\Carlson Projects\APG 2023 Training\Data\Points\Survey.crd.**

If you have skipped previous lessons and opened a project from the provided dataset the CRD file is set to: **C:\Carlson Projects\APG 2023 Lesson 3_2\Data\Points\Survey.crd.**

18. Click **<<OK>>**.

A message is displayed that the points have been imported into the coordinate file.

19. Click **<<OK>>**.

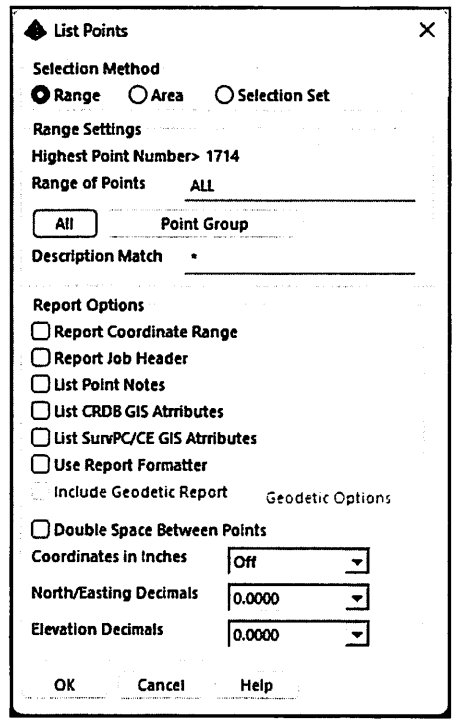


20. Select **Ribbon: Points ⇒ Points ⇒ List Points.**

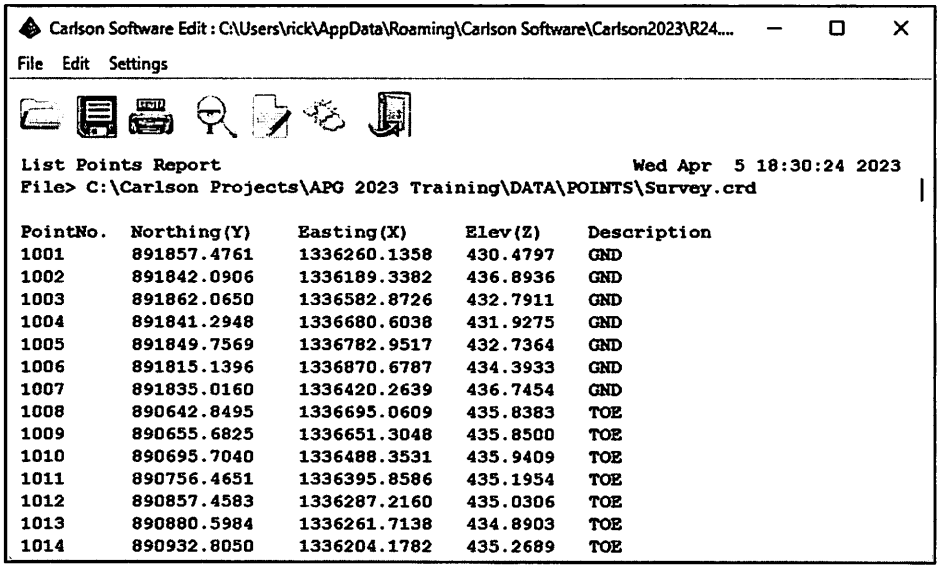
Alternatively, from the pull-down menu: Select **Points ⇒ List Points.**

The *List Points* dialog box is opened.

21. Click **<<All>>**.
22. Click **<<OK>>**.



The report dialog box is displayed.



23. Notice the point data you just imported to the current CRD file is now displayed.
24. Close the report dialog box.

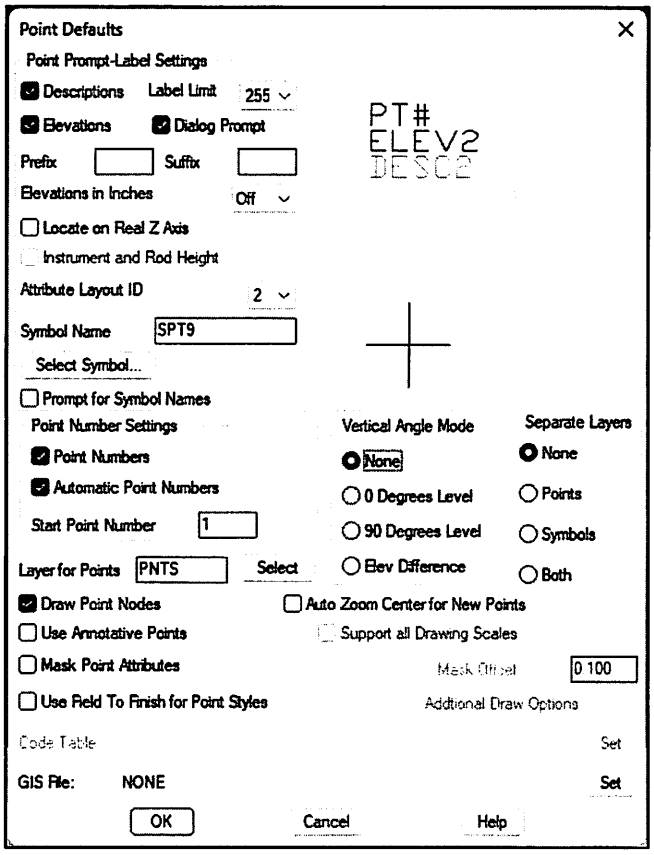
Lesson Review

In this lesson, you imported a typical ASCII text file containing point data into *Carlson Software*, which used it to populate the proprietary binary Carlson.CRD coordinate file.

3.3 Lesson: Point Defaults

Introduction

Point Defaults control the behavior and appearance of Points in the drawing. In this lesson you will explore the different options available for controlling the appearance of points.



Key Concepts

Concepts and key terms covered in this lesson are:

- Point Prompt-Label Settings
- Point Number Settings
- Layer for Points

Objectives

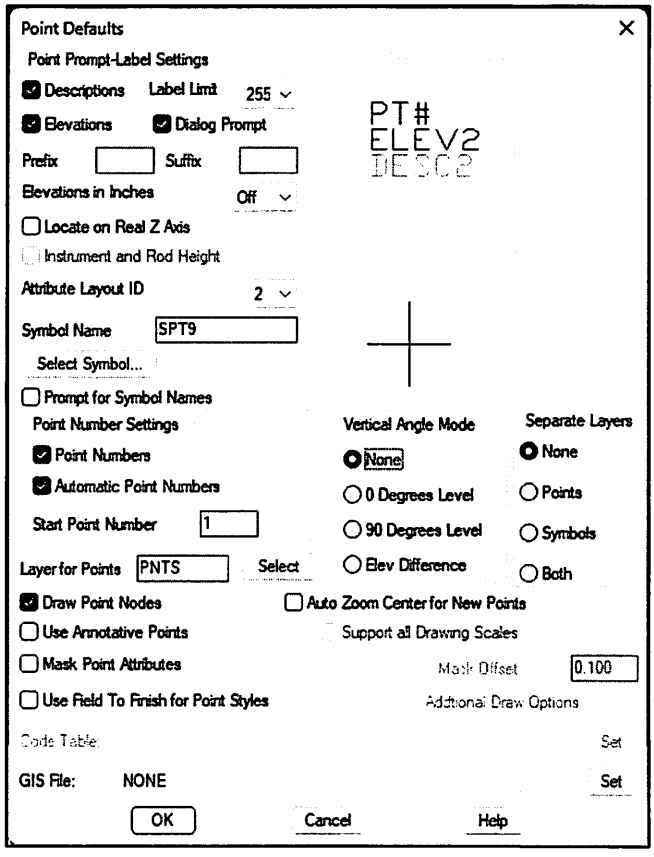
After completing this lesson, you will be able to:

- Describe Point Defaults
- Control Point Appearance with Default Settings

Point Defaults

The overall appearance of Point Blocks in the drawing is primarily controlled by settings within the *Point Defaults* dialog. While there are quite a few options within the dialog, there are a few critical ones, which we will examine.

- Point Prompt-Label Settings
- Locate on Real Z Axis
- Attribute Layout ID
- Symbol Name
- Point Number Settings
- Layer for Points



Note: The **Use Annotative Points** option (the ability for the points to change scale along with the drawing Annotative Scale) is only available when using Carlson with AutoCAD.

Point Prompt-Label Settings

You will typically want to be prompted for *Elevations* and *Descriptions*, so confirm that the options to prompt for them are enabled.

Locate on Real Z Axis

Locate on Real Z Axis will determine if the point blocks are created in the drawing "at elevation", inserted at the actual elevation of the point, based on the data in the database, or whether they are created at elevation 0. If you plan to connect the points manually to draw a base map, it is probably beneficial to have them all at elevation 0 so that the linework you create will also be at 0. If you plan to connect them with 3D linework, it may be beneficial to

have them at their actual elevations in the drawing. At this time we will leave the option to locate on real Z off.

Attribute Layout ID

Your choice of *Attribute Layout ID* will determine the drawing that is used to create the point blocks, and thereby the overall appearance of the point blocks. *Carlson Software* ships with 10 drawings to choose from, each with its own arrangement of attributes. By selecting each one, you can see a preview of them and decide which best fits your needs.

Symbol Name

The *Symbol Name* allows you to choose which symbol is inserted with all the point blocks. In this chapter we are only looking at using Draw Locate to place the point blocks into the drawing. In a later chapter we will look at using *Field to Finish* to place the points into the drawing, in which case the point descriptions can be used to control the symbol that is inserted with the points.

Point Number Settings

Typically you will want point numbers to be used, and to have them automatically assigned, incrementing automatically from the starting point number specified in the dialog. When the Point Numbers option is disabled, no point number will be created and no points will be stored in the CRD file.

Layer for Points

The *Layer for Points* is the drawing layer that the point blocks will be created on. If you are not utilizing *Field to Finish* to control the layers based on the point descriptions, the layer specified here will be the default layer used for points when created in the drawing.

Draw Point Nodes

You can choose whether or not to create CAD point objects (nodes) as part of the point representations created in the drawing.

Use Annotative Points

You can choose whether or not to use Annotative Text for the point attributes created in the drawing, but only if you are running Carlson on an AutoCAD platform.

Use Field to Finish for Point Styles

This option can be selected to enable the use of an existing Field to Finish Code Table (.FLD file) whenever points are created in the drawing, regardless of what command is used, and even if the Carlson Survey program is not purchased. Enabling this option allows the selection of the .FLD Code Table to be used.

Exercise: Setting up Point Defaults

In this exercise you set the Point Defaults to your preferences. Point Defaults are the initial settings for the creation of Points in the drawing.

You do the following:

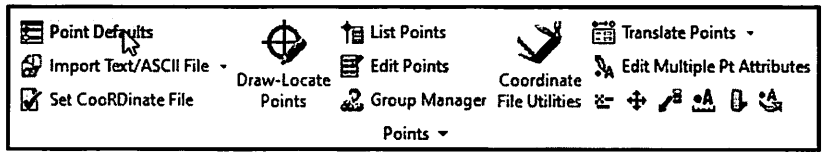
- Access Point Defaults
- Adjust them to your preferences

3.3.1 Setting Up Point Defaults

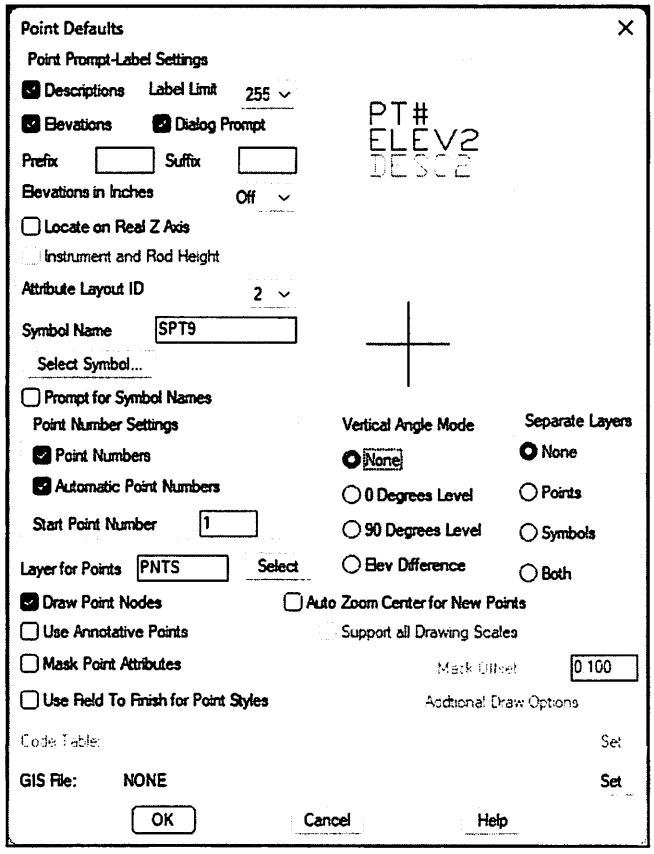
1. Continue working in the drawing **Basemap.dwg**.

If you have not completed the previous lessons:
Open *3_3.dwg* from the project folder *APG 2023 Lesson 3_3*.

2. Select **Ribbon: Points ⇒ Points ⇒ Point Defaults.**



Alternatively, from the pull-down menu:
Select **Points ⇒ Point Defaults.**



3. In the *Point Prompt-Label Settings* section confirm **Descriptions** is enabled.

4. Confirm **Elevations** is enabled.

5. Disable **Locate on Real Z Axis**.

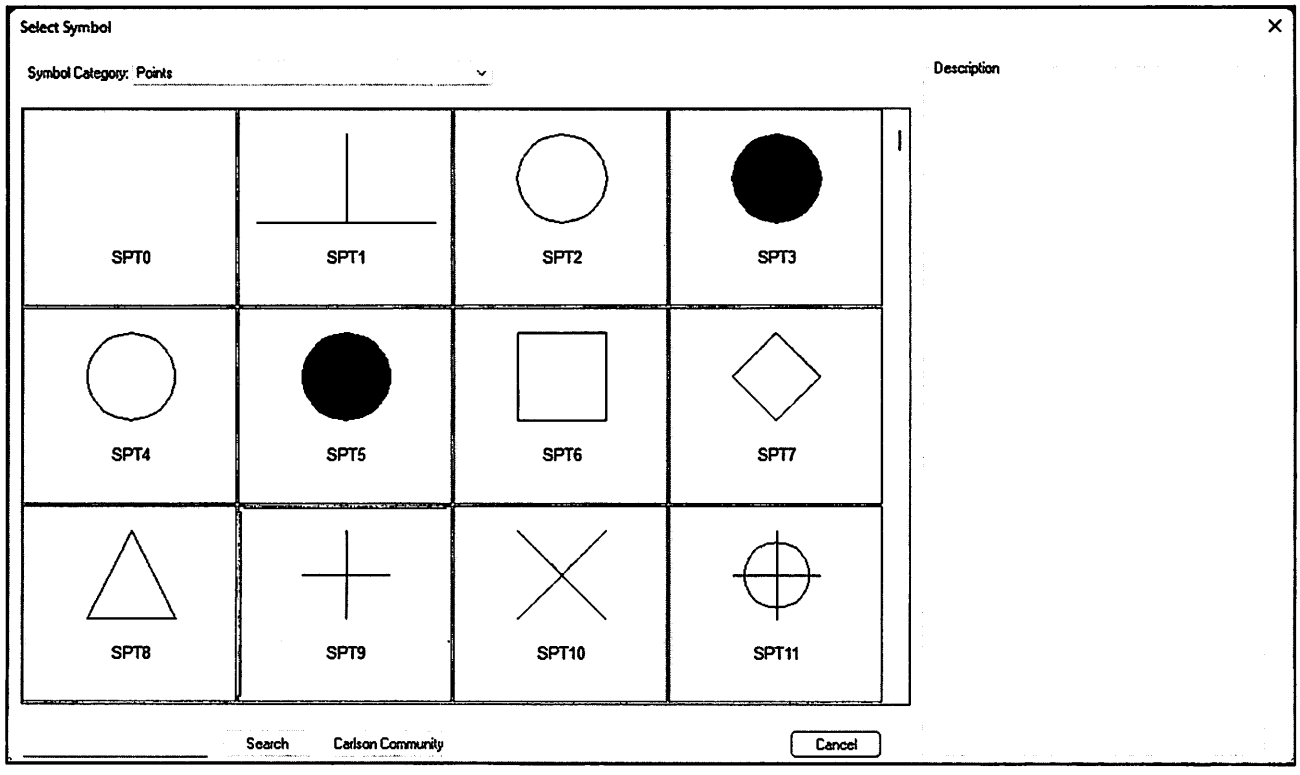
This will create the points at elevation 0, which will be good for creating 2D linework for the basemap later.

6. Set the **Attribute Layout ID** to **2**.

Carlson Software ships with 10 drawings that are used as point blocks, each with its own arrangement of attributes. By selecting each one, you can see a preview of them and decide which best fits your needs.

7. Click **<<Select Symbol>>**.

This opens the *Select Symbol* dialog box.



Scrolling through the drop-down list allows you to select the library containing various symbols in each.

8. Select the Symbol Category **Points.**

9. Select symbol **STP9**.

10. In the *Point Number Settings* section confirm **Point Numbers** is enabled.

11. Confirm **Automatic Point Numbers** is enabled.

This will automatically number the points as they are created rather than prompting you for the point number. The points will be numbered sequentially stating at the *Start Point Number* specified.

12. Confirm the **Layer for Points** is set to **PNTS**.

Since we are not using *Field to Finish* at this time, the layer specified here will be the default layer used for points when created in the drawing.

13. Confirm the **Use Field to Finish for Point Styles** option is disabled.

14. Click **<<OK>>** to save the settings.

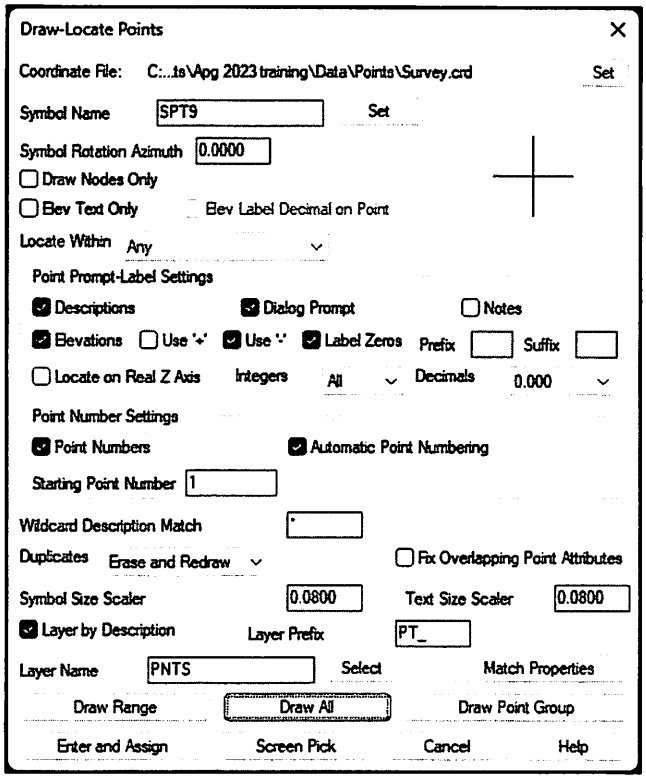
Lesson Review

In this lesson you learned about the different settings for the *Point Defaults* and set them for use with the *Draw-Locate Points* command.

3.4 Lesson: Draw - Locate Points

Introduction

In this lesson we utilize the *Draw - Locate* command to create *Carlson Point Blocks* in the drawing that represent the point records in the external Point Database.



Key Concepts

Concepts and key terms covered in this lesson are:

- Draw-Locate
- Layer by Description

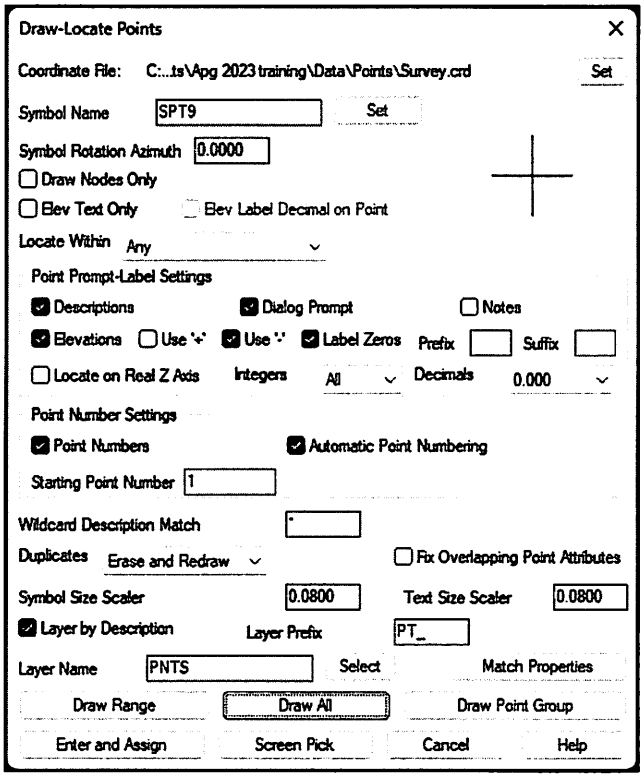
Objectives

After completing this lesson, you will be able to:

- Create Carlson Point Blocks in a Drawing
- Use Draw-Locate to Create New Point Data
- Use the Drawing Inspector

Draw-Locate Points

The *Draw-Locate Points* command is one way to create Carlson Point Blocks in a drawing to represent the records in the external Point Database.



The *Draw-Locate Points* dialog box has two distinct functions.

- Create points in the drawing that already exist within the external point database.
- Create new points, in the drawing and in the external database, simultaneously.

Create points in the drawing that already exists within the external point database

The top row of buttons at the bottom of the dialog box are used for this purpose. You can draw a range of points, specifying a range of point numbers, or you can draw all the points in the database, or you can draw a Point Group, which we will cover in a later lesson.

Create new points, in the drawing and in the external database, simultaneously

The first 2 buttons in the bottom row of the dialog box are used to create new points, in the drawing and in the external database, simultaneously. *Enter and Assign* will prompt you for Northing and Easting information for each point, followed by Elevations and Descriptions, if the prompting for those fields is turned on. *Screen Pick* will prompt you to select locations graphically in the drawing to set points, with or without the use of Object Snaps. Elevations and Descriptions will also be prompted for, if those settings are turned on.

Settings

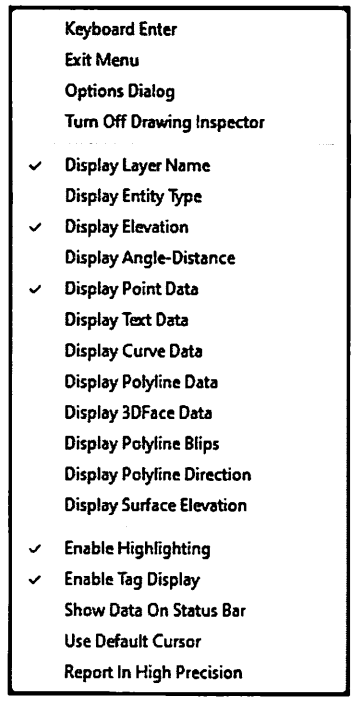
In the *Draw-Locate Points* dialog box many of the settings are already set to the choices you made in the *Point Defaults* command. They can, however, be changed here, and the changes will be used for this specific point creation. In other words, you can easily override the defaults at any time.

The Drawing Inspector

The drawing inspector is a real-time inquiry function that displays user-selected drawing data in the mouse tooltip window simply by moving over drawing entities.

When the *Drawing Inspector* is on you can right-click to see a list of all of the available information that the drawing inspector and display as a cursor tooltip as you hover or roll over objects in the drawing. Just move your cursor over various objects to see these properties displayed.

The drawing inspector's ability to display such a wide variety of drawing/entity information in real-time, without picking objects, without invoking any commands, without needing a flip screen, translates into real productivity and time-saving.



Exercises: Using Draw-Locate Points

In these exercises you use Draw-Locate to draw Points in the drawing that are already defined in the external database, and then use the same command to create new Points in the drawing and the database simultaneously.

You do the following:

- Access Draw-Locate
- Draw Points stored in the .CRD file
- Create new Points in the drawing and the database

3.4.1 Draw Points in a Drawing

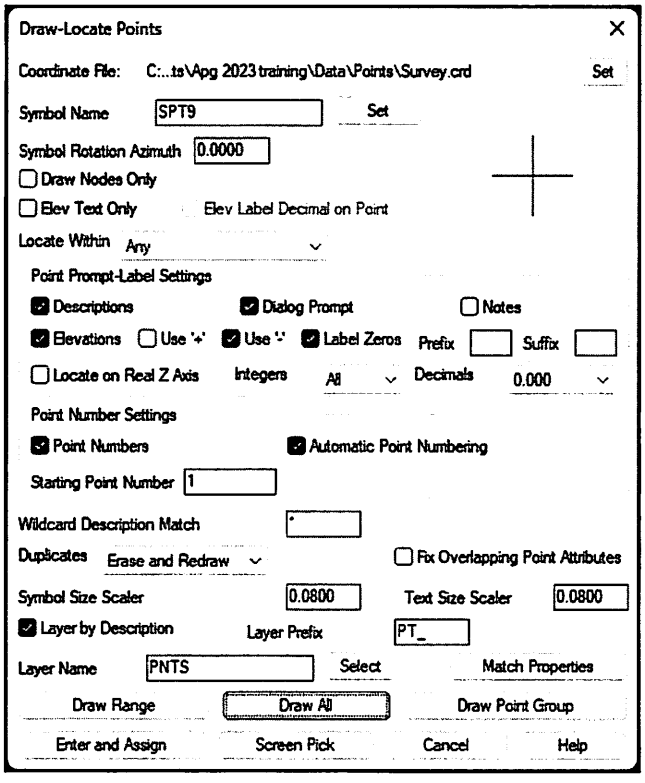
1. Continue working in the drawing **Basemap.dwg**.

If you have not completed the previous lessons:
Open *3_4.dwg* from the project folder *APG 2023 Lesson 3_4*.

2. Select **Ribbon: Points ⇒ Points ⇒ Draw – Locate Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Draw – Locate Points.**

The *Draw-Locate Points* dialog box opens.



Many of the settings within the *Draw-Locate Points* dialog box are already set to the choices you made in the *Point Defaults* dialog. However, they can be changed here, and the changes will be used for this specific point creation. In other words, you can easily override the defaults at any time.

3. Confirm **Layer by Description** is enabled.

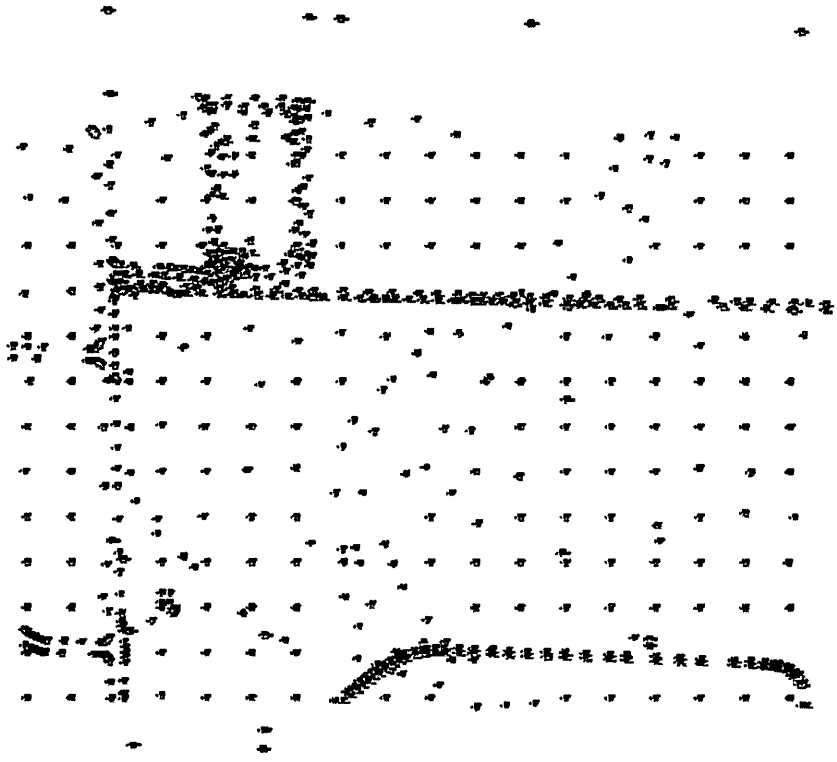
4. Confirm the **Layer Prefix** is set to **PT_**.

5. Confirm the remaining settings are set like the graphic above.

6. Click **<<Draw All>>**.

All of the points in the current .CRD coordinate file are created in the drawing using their respective descriptions as layer names, all with a PT_ prefix.

The imported points will look like the graphic below.



7. Select **Ribbon: Draft ⇒ Inquiry ⇒ Drawing Inspector.**

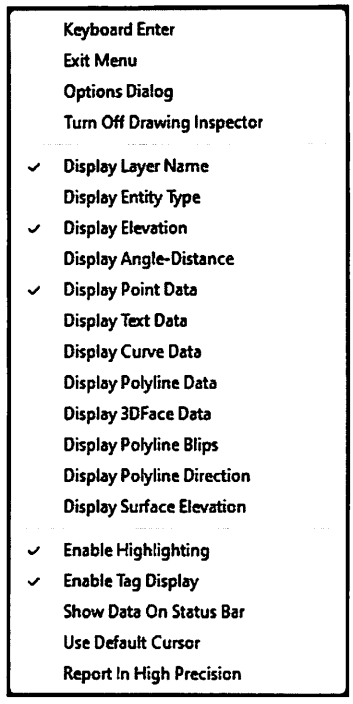
Alternatively, from the pull-down menu:
Select **Inquiry ⇒ Drawing Inspector On/Off.**

8. Right-click to show the drawing inspector options.

9. Enable **Display Layer Name.**

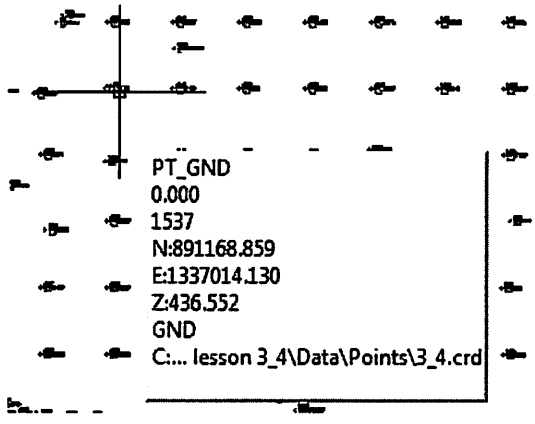
10. Enable **Display Elevation.**

11. Enable **Display Point Data.**



12. Hover over some points to see the layer names and data associated with them.

13. When finished, right-click and select **Turn Off Drawing Inspector.**



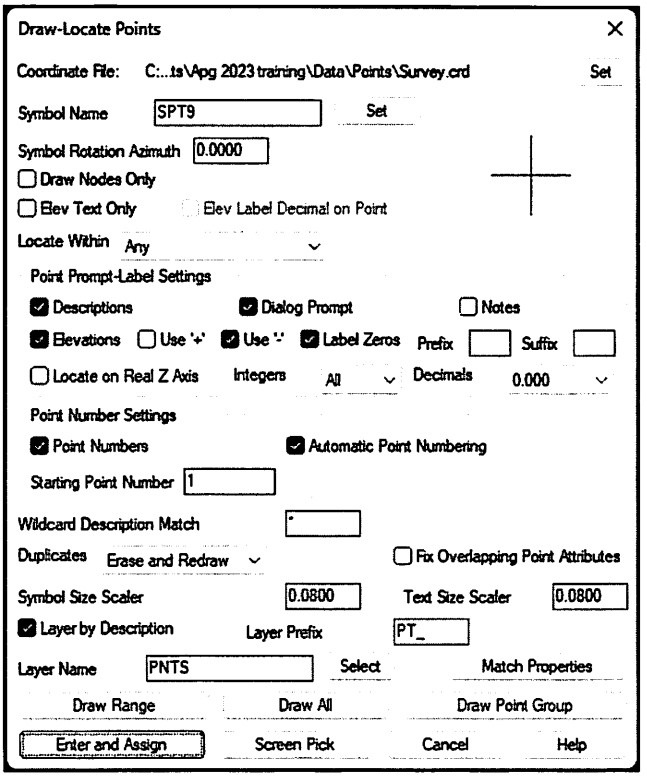
3.4.2 Creating new Points with Draw – Locate Points

1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Points ⇒ Points ⇒ Draw – Locate Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Draw – Locate Points.**

The *Draw-Locate Points* dialog box opens.



Many of the settings within the Draw-Locate Points dialog box are already set to the choices you made in the *Point Defaults* dialog.

3. Confirm the settings are set like the graphic above.

4. Click **<<Enter and Assign>>**.

5. At the command line respond to the prompts as follows:

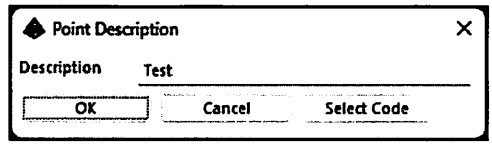
6. Enter North(y): **891000**

7. East(x): **1338000**

8. Point Elevation [Text/Snap/<Enter>] <>: **100**

9. For the Point Description enter **TEST.**

10. Click **<<OK>>.**



11. When prompted for the northing for the next point press **Enter** to end the command.

The new point is created in the drawing and the database.

12. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s).**

13. At the command line respond to the prompts as follows:

14. Find by point number or description [<Number>/Desc]? **N**

15. Point number or range of point numbers to find <1>: **1**

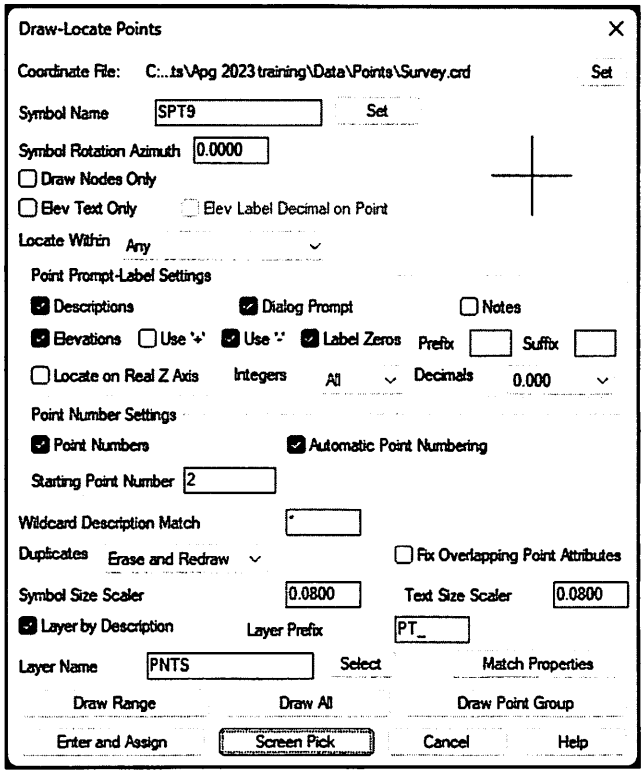
16. Magnification or Height < 80.2>: **40**

Point number 1 will now be in the center of your screen.

17. Select **Ribbon: Points ⇒ Points ⇒ Draw – Locate Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Draw – Locate Points.**

The *Draw-Locate Points* dialog box opens.



18. Confirm the settings are set like the graphic above.

19. Click **<<Screen Pick>>**.

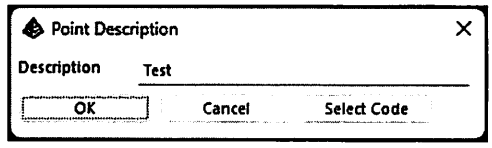
You are prompted to pick locations on the screen to set new points.

20. Pick a location near the point you created earlier in this exercise.

21. At the command line respond to the prompts as follows:

22. Point Elevation [Text/Snap/<Enter>] <>: **100**

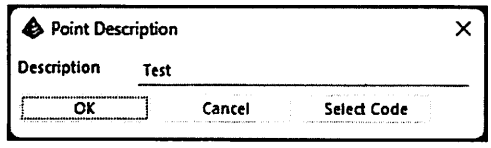
23. For the Point Description enter **TEST.**



24. Pick point to create: pick a second location near the point you created earlier in this exercise to create another point.

25. Point Elevation [Text/Snap/<Enter>] <>: **100**

26. For the Point Description enter **TEST.**



27. Pick point to create: press **Enter** to end the command

The new points are created in the drawing and the database.

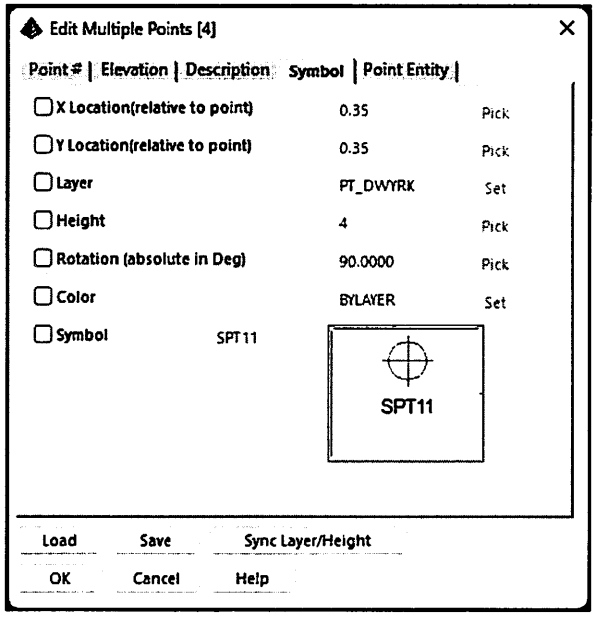
Lesson Review

In this lesson, you used the Draw-Locate command to create point blocks in the drawing to represent the point records in the external .CRD point database. You also used another option of the same command to create new points in the point database and in the drawing.

3.5 Lesson: Controlling Point Display

Introduction

In this lesson we look at a variety of tools within Carlson Software that are available to edit Point Blocks after they have been created in the Drawing.



Key Concepts

Concepts and key terms covered in this lesson are:

- Scale Point Attributes
- Move Point Attributes

Objectives

After completing this lesson, you will be able to:

- Use a variety of Editing Tools to control the display of Point Blocks

Resize Point Attributes

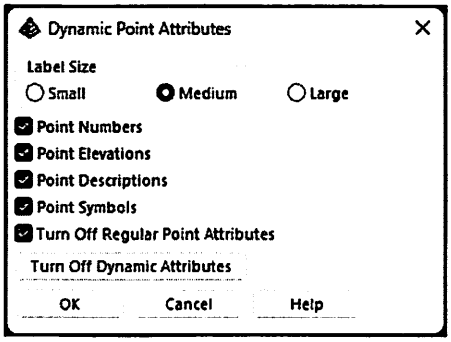
This command allows you resize the point attributes (labels). Once you start the command you have several options at the command line.

You can:

- Resize by scaling the attributes to a percent of their current size or to resize the attributes to a new absolute size.
- Scale symbols only, point labels only or both.
- Select points from screen with standard AutoCAD selection tools, by point group or by entering a range of point numbers.

Dynamic Point Attributes

This command creates point attributes that dynamically resize to view at the current zoom level. This way the point labels appear the same size at any drawing zoom level. These point attributes are for viewing only and are not saved.



Move Point Attributes with Leader

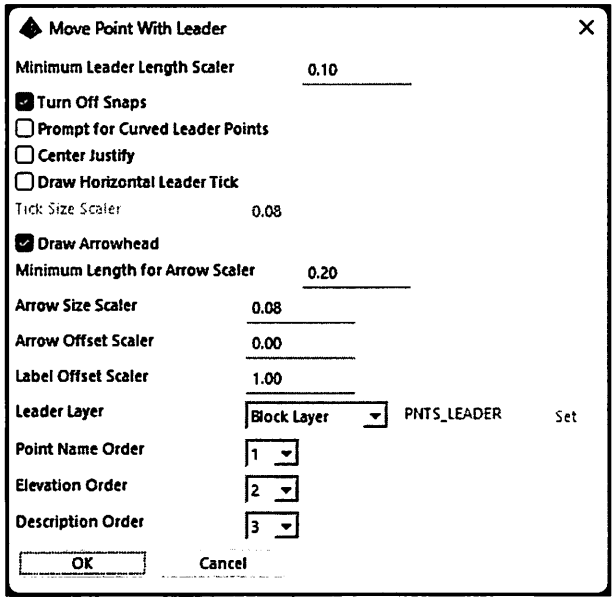
This command allows you to move point attributes, typically to resolve overlaps, without moving the actual point. The attributes move as a group and a leader is created pointing back to the actual point location.

The command's behavior defaults to the immediate selection of a single point block to move the attributes of. Other choices at the command line are:

- Options - to access a dialog box to control the appearance of the leaders.
- Restore - to restore attributes that have been moved back to their default locations (based on the point block used for the point)
- Multiple - to move attributes for multiple point blocks at once
- Group - to specify a Point Group for the points to move the attributes of
- Number - to specify a range of point numbers to move the attributes of

Options

When you select *Options* at the command line during the *Move Point Attributes with Leader* command you get a dialog box with several settings that control the display of the leader that is created when you move the attributes.



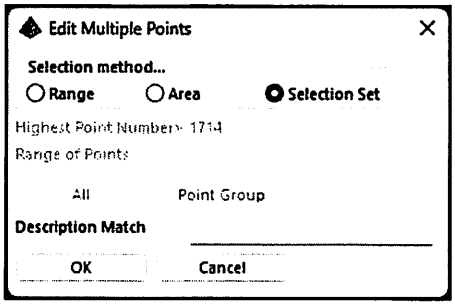
The *Minimum Leader Length Scaler* is a number, on paper, that indicates how far the attributes must be moved from the point itself for a leader to be generated.

The *Minimum Length for Arrow Scaler* is the same idea for the generation of the arrowhead.

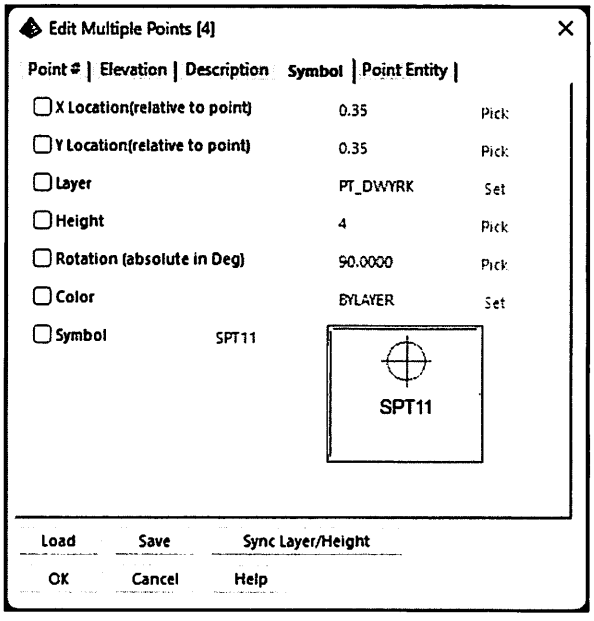
Note: All "Scalers" referred to in *Carlson* dialog boxes are referring to lengths on paper for items on plotted drawings. In English (Imperial) drawings, these are in inches, in Metric drawings they are typically in centimeters.

Edit Multiple Point Attributes

The *Edit Multiple Point Attributes* command consists of two dialog boxes.



The first dialog box allows you to select point by *Number Range*, *Area*, or with a graphical *Selection Set*.



In the second *Edit Multiple Points* dialog box the number of points you have selected appears at the top. You can choose whether to edit the characteristics of the point numbers, elevations, descriptions, and/or symbols.

Exercises: Editing Point Attributes

In these exercises you edit Point Attributes in existing Point blocks. You scale the attributes, move attributes, and edit specific attributes.

You do the following:

- Scale Point Attributes
- Resize Point Attributes Dynamically
- Move Point Attributes
- Edit display of Point Attributes

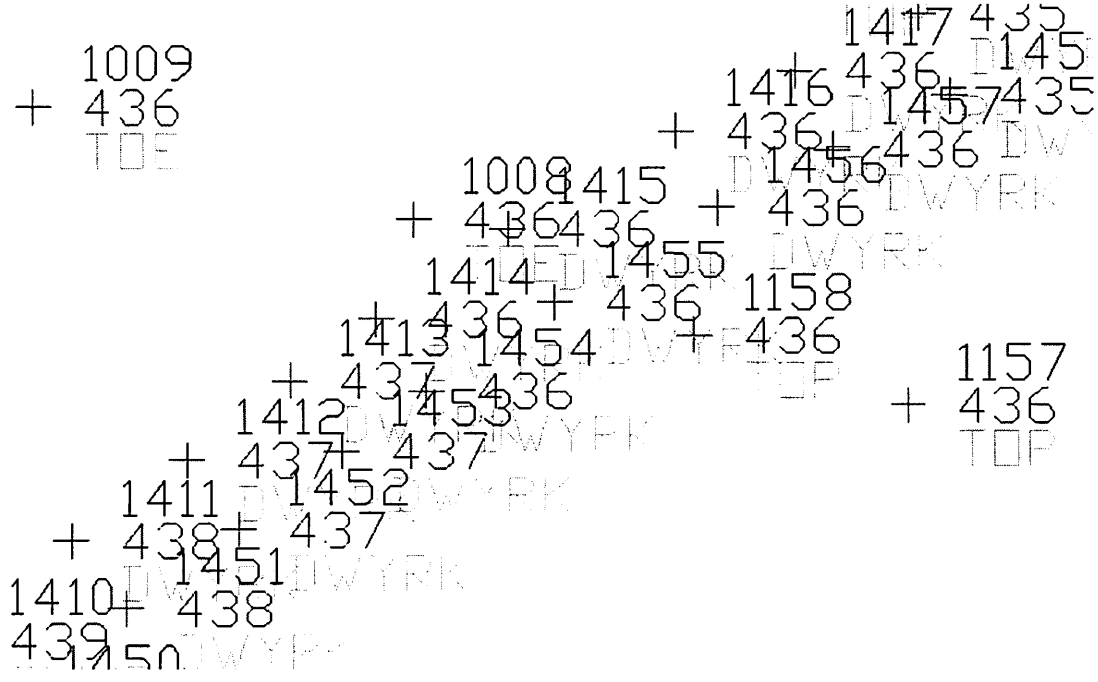
3.5.1 Scaling Attributes

1. Continue working in the drawing **Basemap.dwg**.

If you have not completed the previous lessons:
Open *3_5.dwg* from the project folder *APG 2023 Lesson 3_5*.

2. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s).**
3. At the command line respond to the prompts as follows:
4. Find by point number or description [<Number>/Desc]? **N**
5. Point number or range of point numbers to find <1>: **1414**
6. Magnification or Height < 80.2>: **100**

Point number 1414 will now be in the center of your screen.



In the area shown the surveyed points are located very close together. One solution for this situation is to scale the point attributes for these points. This will not move the location of the points, but will scale all of the attributes in place to make it easier to see the survey data.

7. Select **Ribbon: Points ⇒ Points ⇒ Resize Point Attributes.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Resize Point Attributes.**

8. At the command line respond to the prompts as follows:

9. Method for resizing [<Scale>/Absolute]? **S**

This will scale the attributes (Labels) to a percent of their current size.

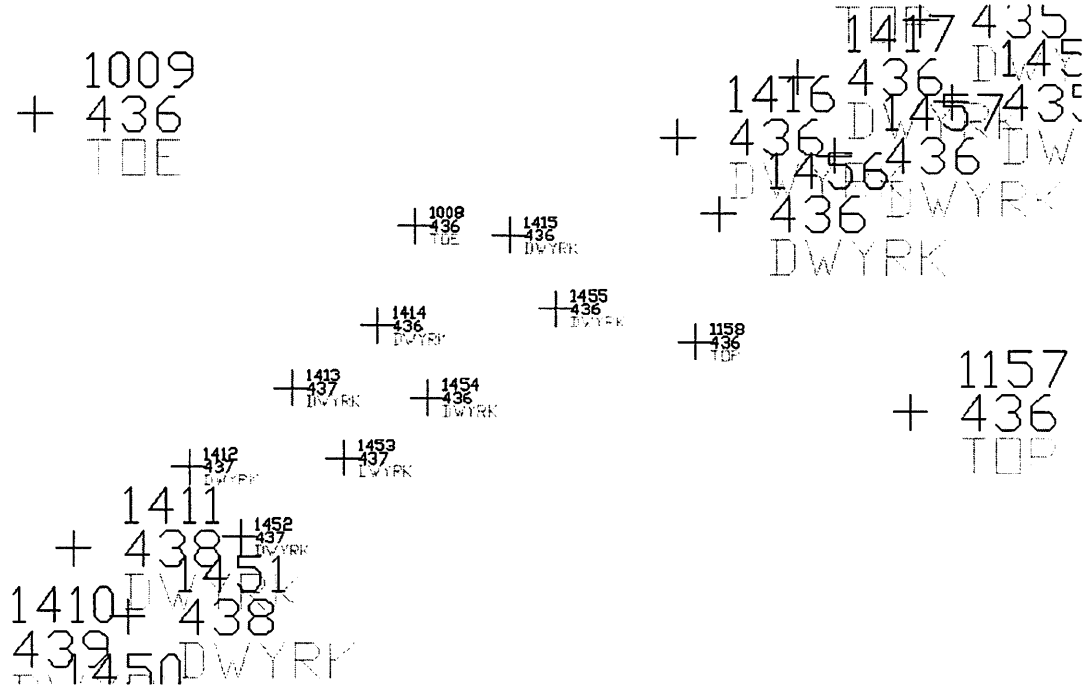
10. Scaling Multiplier <0.500>: **.3**

11. Scale symbols only, point labels only or both [Symbols/Labels/<Both>]? **L**

12. Select points from screen, group or by point number [<Screen>/Group/Number]? **S**

13. Use selection window to pick some of the points that are overlapping. Press **Enter.**

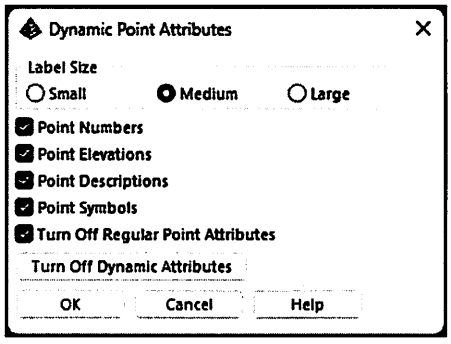
The point attributes are scaled to .3 of their original size, the symbols remain the same, and of course the points maintain their original positions.



3.5.2 Using Dynamic Point Attributes

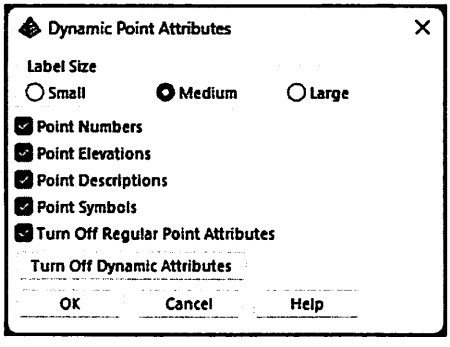
In this exercise you will use the *Dynamic Point Attributes* command to make the display of the points resize as you zoom in and out. This feature can be toggled on and off for use as needed and can be helpful with clumps of points that are close together.

1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu: Select **Points ⇒ Dynamic Point Attributes.**
3. Set the **Label Size** to **Medium.**
4. Enable the **Point Numbers** option.
5. Enable the **Point Elevations** option.
6. Enable the **Point Descriptions** option.
7. Enable the **Point Symbols** option.
8. Enable the **Turn Off Regular Point Attributes** option.
9. Click **<<OK>>.**
10. Zoom in and out. Notice how the points resize automatically.



You may need to REGEN if the original *Point Blocks* are still displayed.

11. From the pull-down menu: Select **Points ⇒ Dynamic Point Attributes.**
12. Click **<< Turn Off Dynamic Attributes>>.**

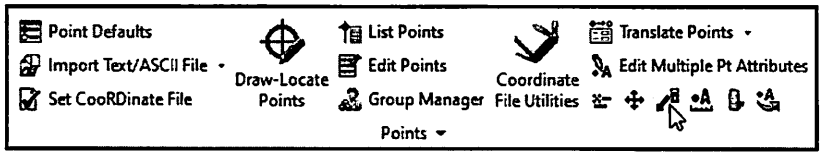


The *Points* are now displayed as *Point Blocks* the same way they were before starting this command.

3.5.3 Moving Attributes

1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Points ⇒ Points ⇒ Move Point Attributes with Leader.**



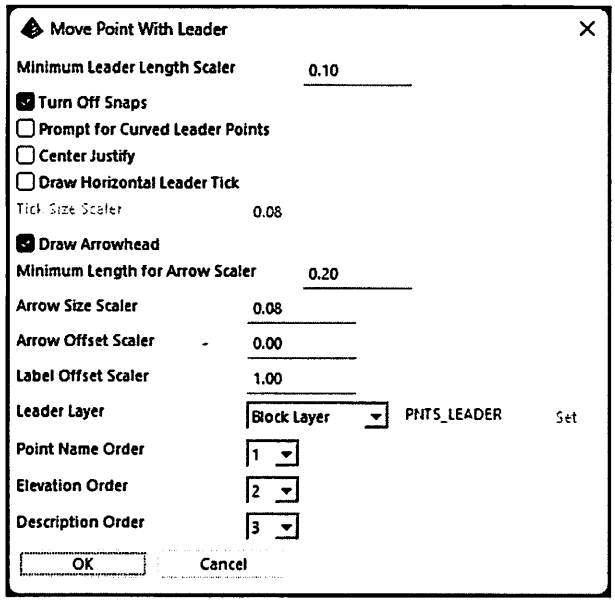
Alternatively, from the pull-down menu:
Select **Points ⇒ Move Point Attributes with Leader.**

3. At the command line type **O** for options.

4. Enable the **Turn Off Snaps** option.

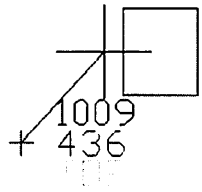
5. Enable the **Draw Arrowhead** option.

6. Click **<<OK>>**.



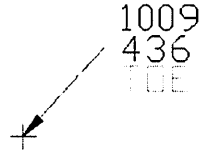
7. Zoom in closer to some points and pick one.

For this exercise it does not matter what point you select, you are only editing the display of the point, not the data.



The attributes of the point become highlighted and a box appears representing the new location for the attributes.

8. Pick the location to move the attributes to and they are relocated with a newly created leader pointing back to the actual location of the point.

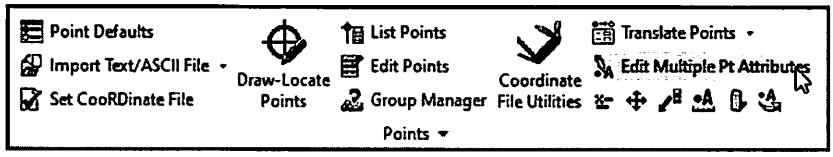


9. Enter to end the command.

3.5.4 Editing Specific Attributes

1. Continue working in the drawing from the previous exercise.

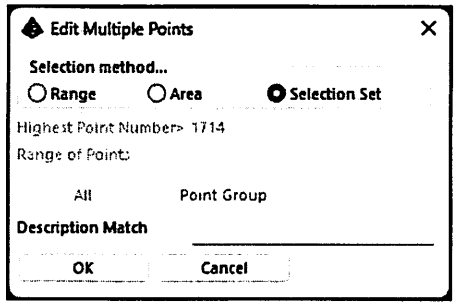
2. Select **Ribbon: Points ⇒ Points ⇒ Edit Multiple Point Attributes.**



Alternatively, from the pull-down menu:
Select **Points ⇒ Edit Multiple Pt Attributes.**

3. Pick the **Selection Set** option for **Selection Method**.

4. Click **<<OK>>**.



5. Select three or four points to edit and press **Enter**.

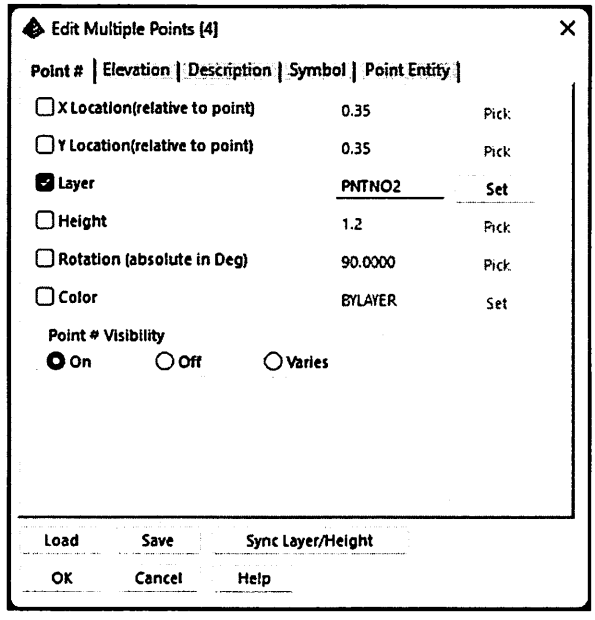
For this exercise it does not matter which points you select, you are only editing the display of the point not the data.

6. On the *Point #* tab enable **Layer**.

You will move the attribute for the point numbers for these points to a different layer so they can be shut Off, while all the other point numbers remain On.

7. Enter **PNTNO2** for the *Layer* name.

Since this layer does not exist in your drawing it will be created for you.

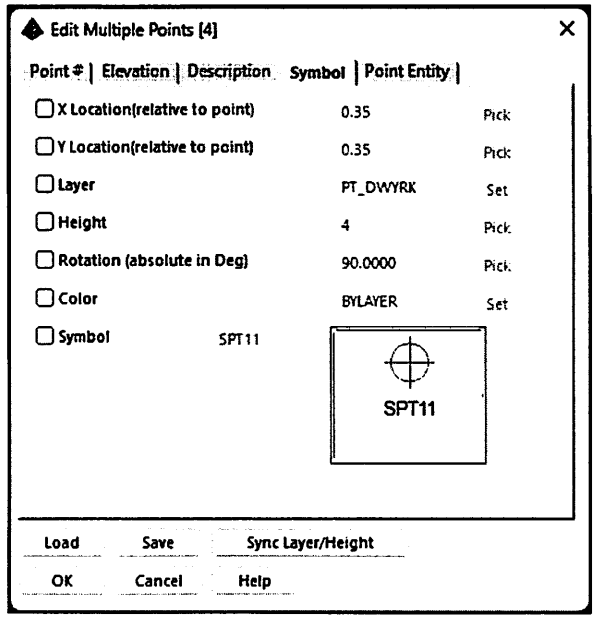


8. Select the *Symbol* tab.

9. Enable **Symbol**.

10. Click the symbol button and select the symbol **SPT11**.

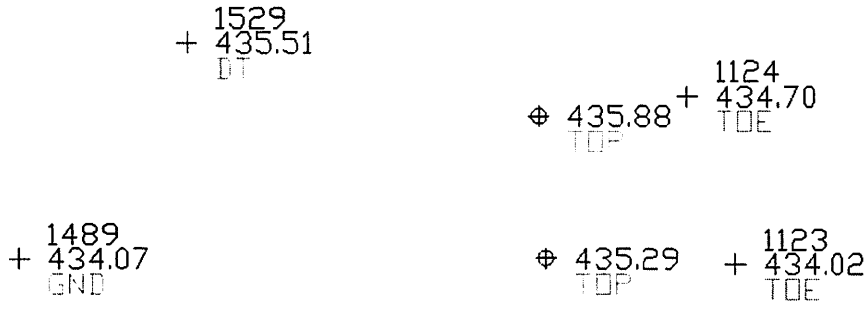
11. Click **<<OK>>**.



12. Zoom into the area of the points you edited. Note the points have a different symbol.

13. In the layer properties pallet, notice there is now a layer **PNTNO2**. Turn that layer **Off**.

The points now have their point number turned off while the other points have their point numbers still visible.



Lesson Review

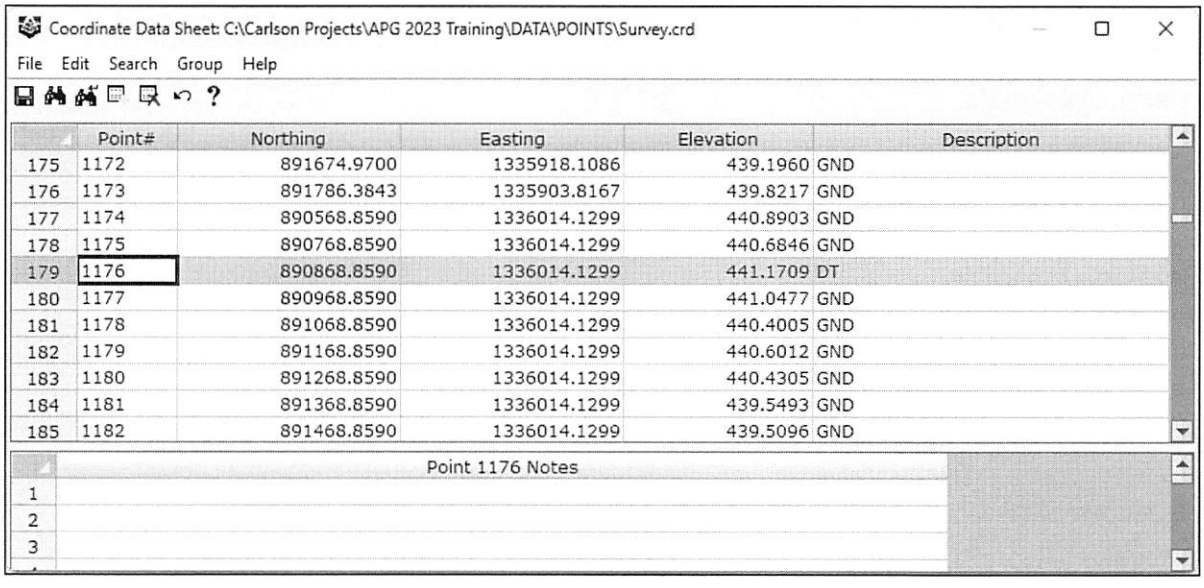
In this lesson, you used several tools to edit specific point attributes as well as scale and move them.

3.6 Lesson: Editing Point Data

Introduction

In this lesson you first look at the Coordinate Data Sheet dialog box that is displayed from the Edit Points command. It can be used to edit the Point Number, Northing, Easting, Elevation, and/or Description of individual point data within the external database itself, and update the point block if it resides in the drawing as well. In Carlson 2023, it can also be used to delete a Range of Points.

In this lesson, you also work with the Edit Point Attributes dialog box. Working on only one point at a time, it allows for access to the listing and potential editing of all Point Attributes listed above, as well as a wide range of additional Point Attributes, including whether the point is to be used for Surface modeling, the display of decimal precision, the Drawing Description vs. the CRD file Description, the Symbol used in the drawing, GIS attribute data, and specification of associated image(s) with the point.


Coordinate Data Sheet: C:\Carlson Projects\APG 2023 Training\DATA\POINTS\Survey.crd
File Edit Search Group Help
Point 1176 Notes

	Point#	Northing	Easting	Elevation	Description
175	1172	891674.9700	1335918.1086	439.1960	GND
176	1173	891786.3843	1335903.8167	439.8217	GND
177	1174	890568.8590	1336014.1299	440.8903	GND
178	1175	890768.8590	1336014.1299	440.6846	GND
179	1176	890868.8590	1336014.1299	441.1709	DT
180	1177	890968.8590	1336014.1299	441.0477	GND
181	1178	891068.8590	1336014.1299	440.4005	GND
182	1179	891168.8590	1336014.1299	440.6012	GND
183	1180	891268.8590	1336014.1299	440.4305	GND
184	1181	891368.8590	1336014.1299	439.5493	GND
185	1182	891468.8590	1336014.1299	439.5096	GND

	Point 1176 Notes
1	
2	
3	

Key Concepts

Concepts and key terms covered in this lesson are:

- Editing Existing Point Data

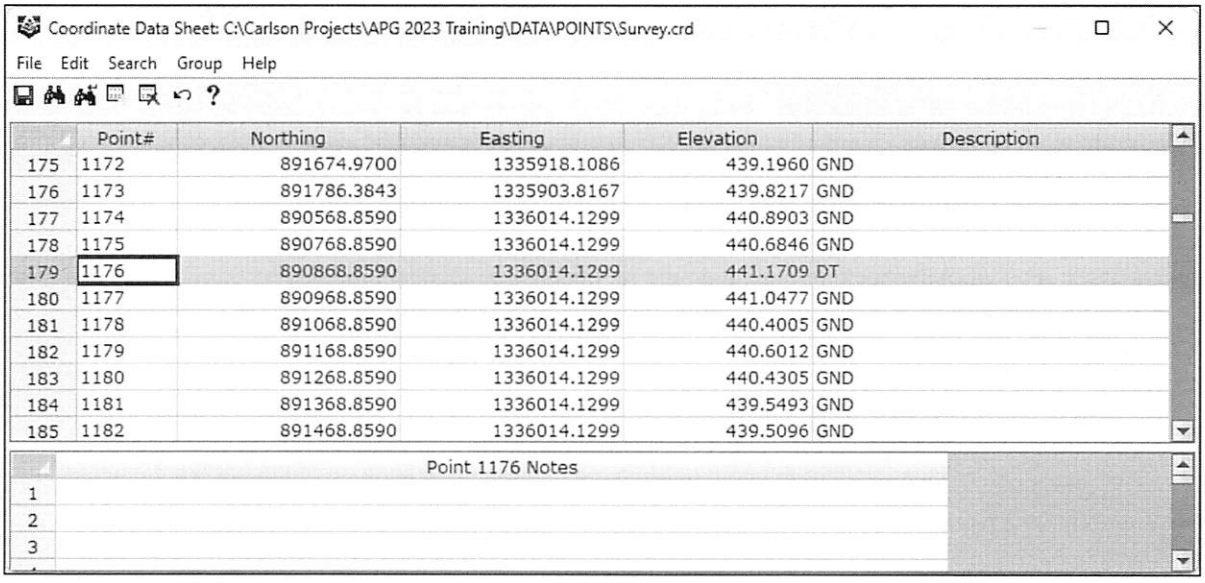
Objectives

After completing this lesson, you will be able to:

- Utilize the Point Editing and Edit Point Attributes dialog boxes
- Edit Point Data in the External Database and the Drawing
- View and edit a variety of Point Attributes

Editing Point Data with the Edit Points command

It is a common situation where some part of the point data for individual points or multiple points needs to be edited.


Coordinate Data Sheet: C:\Carlson Projects\APG 2023 Training\DATA\POINTS\Survey.crd
File Edit Search Group Help
Point 1176 Notes

	Point#	Northing	Easting	Elevation	Description
175	1172	891674.9700	1335918.1086	439.1960	GND
176	1173	891786.3843	1335903.8167	439.8217	GND
177	1174	890568.8590	1336014.1299	440.8903	GND
178	1175	890768.8590	1336014.1299	440.6846	GND
179	1176	890868.8590	1336014.1299	441.1709	DT
180	1177	890968.8590	1336014.1299	441.0477	GND
181	1178	891068.8590	1336014.1299	440.4005	GND
182	1179	891168.8590	1336014.1299	440.6012	GND
183	1180	891268.8590	1336014.1299	440.4305	GND
184	1181	891368.8590	1336014.1299	439.5493	GND
185	1182	891468.8590	1336014.1299	439.5096	GND

	Point 1176 Notes
1	
2	
3	

You may elect to change the:

- Point Number
- Northing
- Easting
- Elevation
- Description
- Notes

You can also select a range of points to delete.

These edits are saved directly to the external CRD file, and also update the point blocks in the drawing.

Editing Points with the Edit Point Attributes command

This dialog box gives you access to a wider range of point attributes for viewing and editing.

Exercises: Editing Point Data in Two Ways

In the first exercise, you will edit the descriptions of several points. The data in the external database will be changed, and the point blocks in the drawing will reflect those changes as well. In the second exercise, you use the Edit Point Attributes command to view and edit other aspects of a point.

You do the following:

- Zoom to a Point
- Edit a Point Description
- Edit additional Point attributes

3.6.1 Editing Point Data with the Edit Points command

1. Continue working in the drawing **Basemap.dwg**.

If you have not completed the previous lessons:
Open *3_6.dwg* from the project folder *APG 2023 Lesson 3_6*.

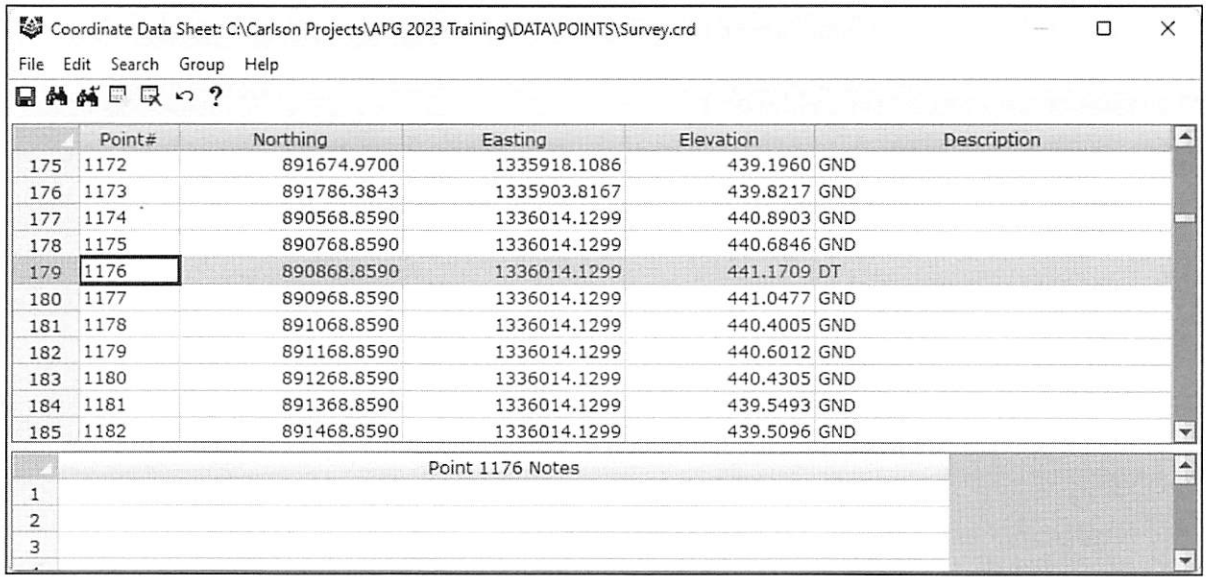
2. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s)**.
3. At the command line respond to the prompts as follows:
4. Find by point number or description [<Number>/Desc]? **N**
5. Point number or range of point numbers to find <1>: **1176**
6. Magnification or Height < 80.2>: **100**

Point number 1176 has a description of GND when it is actually a tree. You will now edit the description and update the point database.

7. Select **Ribbon: Points ⇒ Points ⇒ Edit Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Edit Points.**

The *Coordinate Data Sheet* dialog box opens.


Coordinate Data Sheet: C:\Carlson Projects\APG 2023 Training\DATA\POINTS\Survey.crd
File Edit Search Group Help
Point 1176 Notes

	Point#	Northing	Easting	Elevation	Description
175	1172	891674.9700	1335918.1086	439.1960	GND
176	1173	891786.3843	1335903.8167	439.8217	GND
177	1174	890568.8590	1336014.1299	440.8903	GND
178	1175	890768.8590	1336014.1299	440.6846	GND
179	1176	890868.8590	1336014.1299	441.1709	DT
180	1177	890968.8590	1336014.1299	441.0477	GND
181	1178	891068.8590	1336014.1299	440.4005	GND
182	1179	891168.8590	1336014.1299	440.6012	GND
183	1180	891268.8590	1336014.1299	440.4305	GND
184	1181	891368.8590	1336014.1299	439.5493	GND
185	1182	891468.8590	1336014.1299	439.5096	GND

	Point 1176 Notes
1	
2	
3	

8. Change the *Description* for point **1176** to **DT.**

9. In the *Coordinate Data Sheet* dialog box select **File ⇒ Save and Exit.**

10. Notice the description for point **1176** is changed to **DT** in the drawing, and it is simultaneously updated in the CRD file.

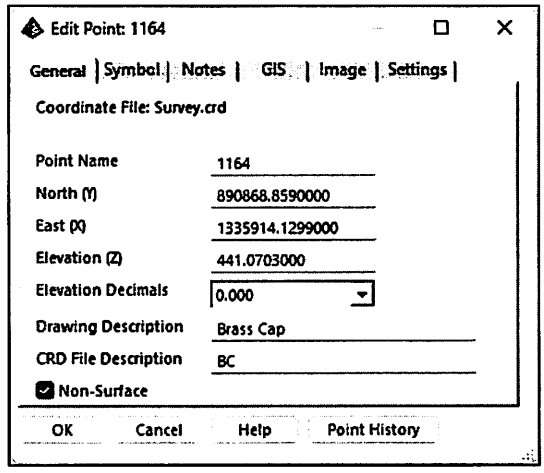
3.6.2 Editing Point Data with the Edit Point Attributes command

1. Continue working in Basemap.dwg or 3_6.dwg.
2. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s).**
3. At the command line respond to the prompts as follows:
4. Find by point number or description [<Number>/Desc]? **N**
5. Point number or range of point numbers to find <1>: **1164**
6. Magnification or Height < 80.2>: **100**
7. Select **Ribbon: Points ⇒ Points ⇒ Edit Point Attributes.**

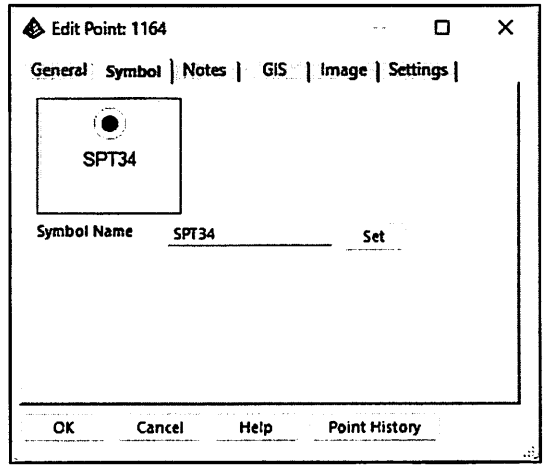
Alternatively, from the pull-down menu:
Select **Points ⇒ Edit Point Attributes.**

8. Pick point **1164**.

You can also just Double-Click on a point to start this command.

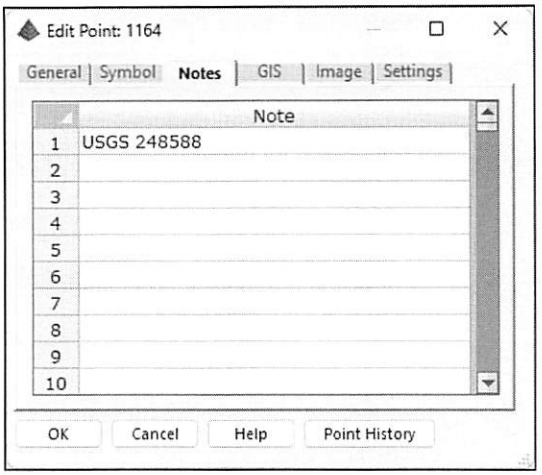


9. On the General tab, change the **Drawing Description** to **Brass Cap**.
10. Change the **CRD File Description** to **BC**.
11. Enable the **Non-Surface** option, so that if this point is selected as part of the Surface modeling process, it will be ignored when creating a surface.
12. Select the **Symbol** tab.
13. Click the **<<Set>>** button.
14. In the *Select Symbol* dialog box set the **Symbol Category** to Points.
15. Set the **Symbol** to **SPT34**.



16. Select the **Notes** tab.

17. Enter a note of **USGS 248588**.



Note: The GIS tab displays any GIS attribute information associated with this point. It is only available when using the CRDB coordinate file format.

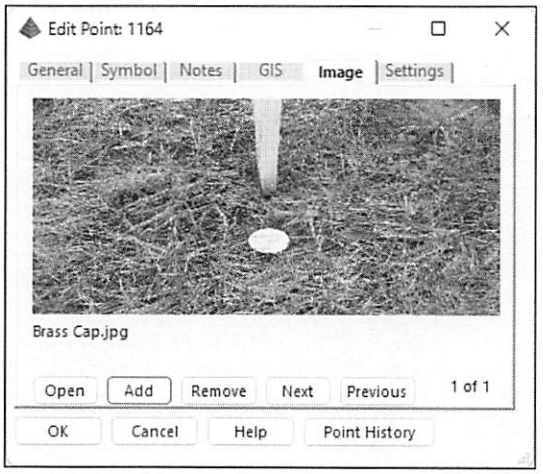
18. Select the **Image** tab.

19. Click **<<Add>>**.

20. Browse to **C:\Carlson Projects\APG 2023 Data\Images\Brass Cap.jpg**.

21. Click **<<Open>>**.

22. Click **<<OK>>** to update the point attributes.



23. Notice the description of the point and symbol have changed in the drawing.

24. Enter to end the command.

25. You can run the command again to see all the data you changed and view the image as well.

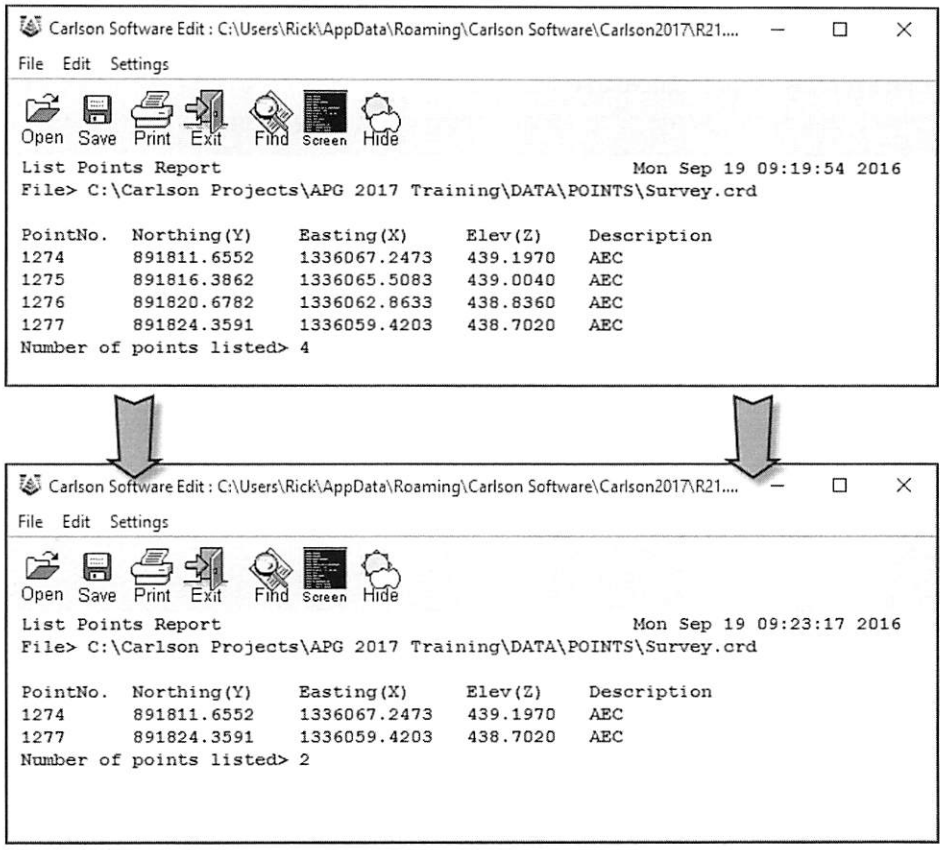
Lesson Review

In this lesson, you edited the attributes of points in the external point database, (CRD File), as well as their appearance in the drawing file.

3.7 Lesson: Erasing Points

Introduction

In this lesson we look at the command designed specifically to erase point blocks and/or point data within the external database.


Carlson Software Edit : C:\Users\Rick\AppData\Roaming\Carlson Software\Carlson2017\R21....
File Edit Settings
Open Save Print Exit Find Screen Hide
List Points Report Mon Sep 19 09:19:54 2016
File> C:\Carlson Projects\APG 2017 Training\DATA\POINTS\Survey.crd
PointNo. Northing(Y) Easting(X) Elev(Z) Description
1274 891811.6552 1336067.2473 439.1970 AEC
1275 891816.3862 1336065.5083 439.0040 AEC
1276 891820.6782 1336062.8633 438.8360 AEC
1277 891824.3591 1336059.4203 438.7020 AEC
Number of points listed> 4
Carlson Software Edit : C:\Users\Rick\AppData\Roaming\Carlson Software\Carlson2017\R21....
File Edit Settings
Open Save Print Exit Find Screen Hide
List Points Report Mon Sep 19 09:23:17 2016
File> C:\Carlson Projects\APG 2017 Training\DATA\POINTS\Survey.crd
PointNo. Northing(Y) Easting(X) Elev(Z) Description
1274 891811.6552 1336067.2473 439.1970 AEC
1277 891824.3591 1336059.4203 438.7020 AEC
Number of points listed> 2

Key Concepts

Concepts and key terms covered in this lesson are:

- Options when Erasing Points
- Drawing Objects vs. External Database

Objectives

After completing this lesson, you will be able to:

- Remove Points from Drawing
- Delete Points from External Point Database

Removing Point Blocks from the drawing

There are times when you may want to erase the point blocks in the drawing that represent the point data in the external point database, without deleting the point data itself. A simple CAD erase command is acceptable for this purpose, but there is also a specific Carlson command designed for this task.

The *Erase Point* command is preferable to a simple CAD Erase command, as it automatically filters for points, so you don't have to manipulate layers to isolate them to erase them.

Deleting Point Data from the External Point Database

In other circumstances, you may need to actually delete some or all of the point data stored in the external point database. We will actually use the same command used in the previous exercise, but select different options.

Exercises: Erasing Points from the Drawing and/or the Point Database

In these exercises you use the specific Carlson commands to Erase Points from just the drawing, then you will learn to Erase Points from the Drawing and the Database simultaneously.

You do the following:

- Erase Points from Drawing
- Erase Points from the .CRD

3.7.1 Erasing Point Blocks from a Drawing

In this exercise we will erase the point blocks in the drawing that represent a small range of point numbers, without deleting the point data from the external database.

1. Continue working in the drawing **Basemap.dwg**.

If you have not completed the previous lessons:
Open *3_7.dwg* from the project folder *APG 2023 Lesson 3_7.*

2. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s)**.
3. At the command line respond to the prompts as follows:
4. Find by point number or description [<Number>/Desc]? **N**
5. Point number or range of point numbers to find <1023>: **1274-1277**
6. Magnification or Height < 40 >: **35**
7. From the pull-down menu: Select **Points ⇒ Erase Points.**
8. At the command line respond to the prompts as follows:
9. Select points from screen, group or by point number [<Screen>/Group/Number]? **S**

10. Graphically select points **1275-1276** and press **Enter.**

11. Delete points from coordinate file [Yes/<No>]? **N**

12. Delete point symbols, attributes or both [<Both>/Symbols/Attributes]? **B**

This method is preferable to a simple CAD Erase command, as this automatically filters for points, so you don't have to manipulate layers to isolate them to erase them.

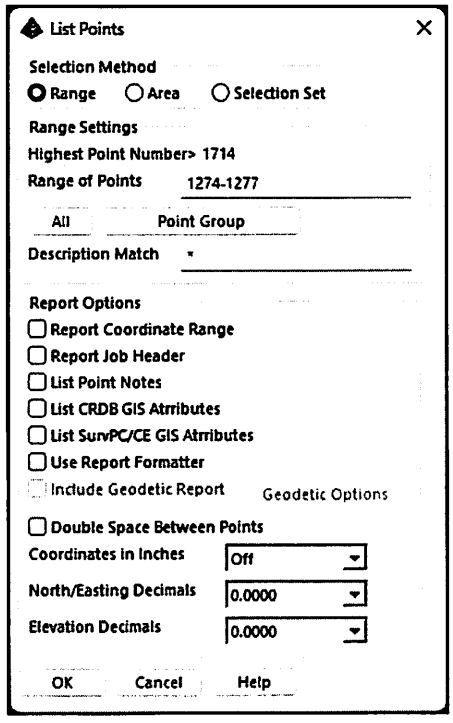
13. Select
Ribbon: Points ⇒
Points ⇒ List Points.

Alternatively, from the pull-down menu:
Select **Points ⇒ List Points.**

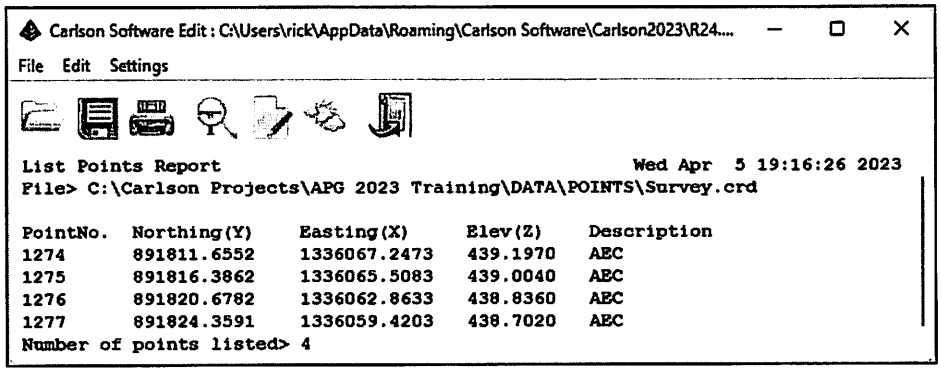
The *List Points* dialog box is opened.

14. For Range of Points enter **1274 - 1277.**

15. Click **<<OK>>.**



The report dialog box is displayed.


Carlson Software Edit : C:\Users\rick\AppData\Roaming\Carlson Software\Carlson2023\R24....
File Edit Settings
List Points Report Wed Apr 5 19:16:26 2023
File> C:\Carlson Projects\APG 2023 Training\DATA\POINTS\Survey.crd
PointNo. Northing(Y) Easting(X) Elev(Z) Description
1274 891811.6552 1336067.2473 439.1970 AEC
1275 891816.3862 1336065.5083 439.0040 AEC
1276 891820.6782 1336062.8633 438.8360 AEC
1277 891824.3591 1336059.4203 438.7020 AEC
Number of points listed> 4

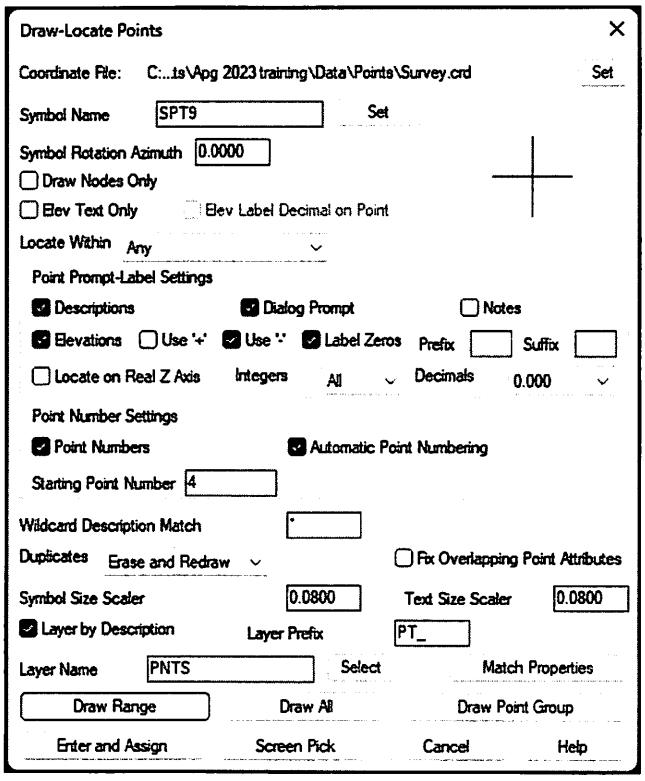
16. Notice in the report that points 1275 - 1276 are still intact in the external point database.

17. Close the report dialog box.

18. Select **Ribbon: Points ⇒ Points ⇒ Draw – Locate Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Draw – Locate Points.**

The *Draw-Locate Points* dialog box opens.



Many of the settings within the *Draw-Locate Points* dialog box are already set to the choices you made in the *Point Defaults* dialog. However, they can be changed here, and the changes will be used for this specific point creation.

19. Confirm **Layer by Description** is enabled.

20. Confirm the **Layer Prefix** is set to **PT_**.

21. Confirm the remaining settings are set like the graphic above.

22. Click **<<Draw Range>>**.

23. At the command line enter **1275-1276** for the *Point number to draw.*

The points that you previously erased from the drawing are redrawn.

24. **Enter** to end the command.

3.7.2 Deleting Point Data from the External Point Database

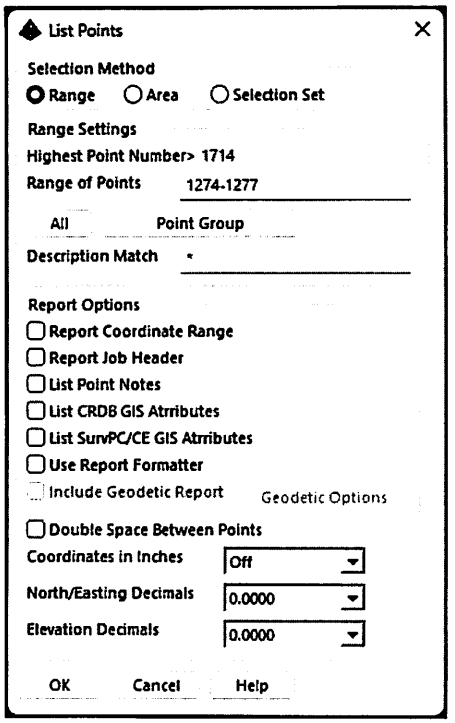
In this exercise you will erase the point blocks in the drawing that represent points 1275-1276, and at the same time erase those points from the external database.

1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s).**
3. At the command line respond to the prompts as follows:
4. Find by point number or description [<Number>/Desc]? **N**
5. Point number or range of point numbers to find <1023>: **1274-1277**
6. Magnification or Height < 40 >: **35**
7. From the pull-down menu: Select **Points ⇒ Erase Points.**
8. At the command line respond to the prompts as follows:
9. Select points from screen, group or by point number [<Screen>/Group/Number]? **S**
10. Graphically select points **1275-1276** and press **Enter.**
11. Delete points from coordinate file [Yes/<No>]? **Y**
12. Are you sure you want to delete points from coordinate file [Yes/<No>]? **Y**
13. Delete point symbols, attributes or both [<Both>/Symbols/Attributes]? **B**
14. Select **Ribbon: Points ⇒ Points ⇒ List Points.**

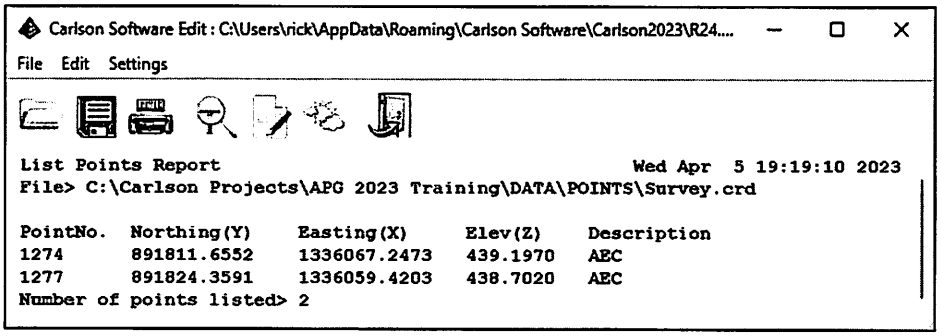
Alternatively, from the pull-down menu:
Select **Points ⇒ List Points.**

The *List Points* dialog box is opened.

15. For Range of Points enter **1274 - 1277**.
16. Click **<<OK>>**.



The report dialog box is displayed.


Carlson Software Edit : C:\Users\rick\AppData\Roaming\Carlson Software\Carlson2023\R24....
File Edit Settings
List Points Report Wed Apr 5 19:19:10 2023
File> C:\Carlson Projects\APG 2023 Training\DATA\POINTS\Survey.crd
PointNo. Northing(Y) Easting(X) Elev(Z) Description
1274 891811.6552 1336067.2473 439.1970 AEC
1277 891824.3591 1336059.4203 438.7020 AEC
Number of points listed> 2

17. Notice in the report that points **1275-1276** are no longer in the external point database (.CRD file).
18. Close the report dialog box.

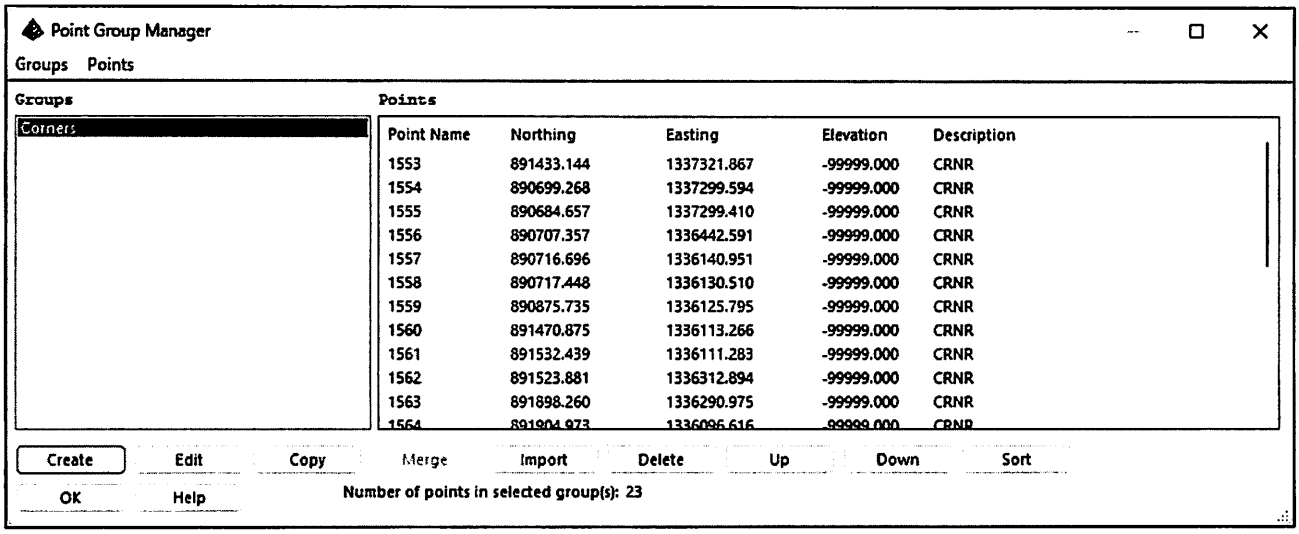
Lesson Review

In this lesson you learned how to erase points from the drawing without impacting the external point database, and also how to erase points from the drawing and the external point database simultaneously.

3.8 Lesson: Using Point Groups

Introduction

In this lesson we look at the use of Point Groups to organize your point data, and some of the subsequent uses of those groups.



Key Concepts

Concepts and key terms covered in this lesson are:

- Point Groups
- Filters
- Applications of Point Groups

Objectives

After completing this lesson, you will be able to:

- Learn what Point Groups are
- Learn how to Create Point Groups
- Learn various applications of Point Groups

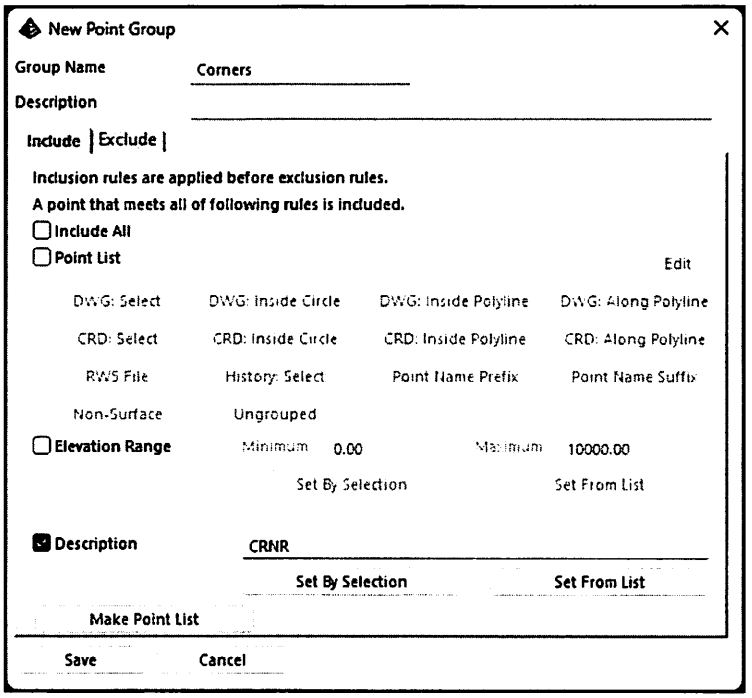
Advantages of using Point Groups

Point Groups are a powerful and versatile tool to organize your point data. Some uses of Point Groups include:

- Controlling Point Display
- Editing Points
- Drawing Points
- Field to Finish
- Selecting Points to build a Surface
- Exporting specific Points
- Creating Point Tables
- Generating Reports

Creating Point Groups

Point Groups are saved selection sets of points. They can be created by setting up a query (or filter) that sorts through all the points in the current .CRD and selects the ones that match the criteria. Point groups can be based on a variety of criteria including point numbers, point elevations, point descriptions and logical combinations thereof.

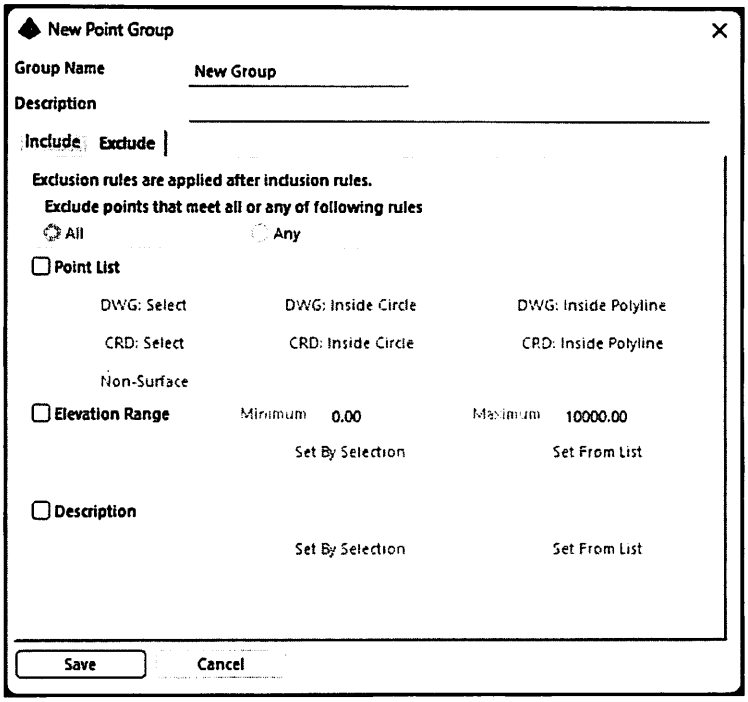


The *New Point Group* dialog box consists of an *Include* tab and an *Exclude* tab. First the filtering criteria specified on the *Include* tab is applied to the entire current coordinate file. The resulting list of points is created and held in memory. Note that on the *Include* tab, all specified filter criteria must be met for a point to be included.

Components of the Query can include any combination of:

- A Range of point numbers, selected from the Drawing or the .CRD, found in the Drawing or the .CRD that fall within a drawn Circle, or found within the Drawing or the .CRD within a drawn Polyline
- Elevation Range
- Descriptions
- All Points in the database

Next, the filtering criteria specified on the *Exclude* tab is applied to that temporary list. Any points in the list that match the exclude criteria are removed from the list to create the final Point Group.



On the *Exclude* tab, the user specifies whether the points to be excluded must match *All* of the filter criteria, or *Any* of the filtering criteria. Using all of these variables in different combinations can produce a very specific set of points.

Components of the Query can exclude any combination of:

- A range of point numbers, using the same methods as described for Include
- Elevation Range
- Descriptions

How Point Groups Work

The parameters that define Point Groups are stored in files with a .GRP file extension, and the same filename as the .CRD coordinate file they are to be applied to. Each Point Group file is associated with one and only one CRD file, as determined by the filename. For example, Test.grp will only refer to points in Test.crd in the same directory.

Each Point Group file contains a number of Point Groups. Each Point Group contains rules for selecting the points within the *.crd file. This file is not intended to be edited manually. The Point Group Manager in Carlson Software is the correct tool to use to edit the Point Group rules and/or to add or remove Point Groups.

Point Groups are dynamic, inasmuch as the .CRD file is read in its current state whenever Point Groups are employed. So if Points that belong in a specific Point Group are added to or deleted from the .CRD, the next time Point Groups are used, they will be updated to the current state of the .CRD.

Exercises: Working with Point Groups

In these exercises you create a Point Groups, using filtering of descriptions, and then use the new Point Group with *Draw-Locate* to draw that specific set of Points in the Drawing.

You do the following:

- Create a Point Group
- Draw a Point Group

3.8.1 Creating a Point Group

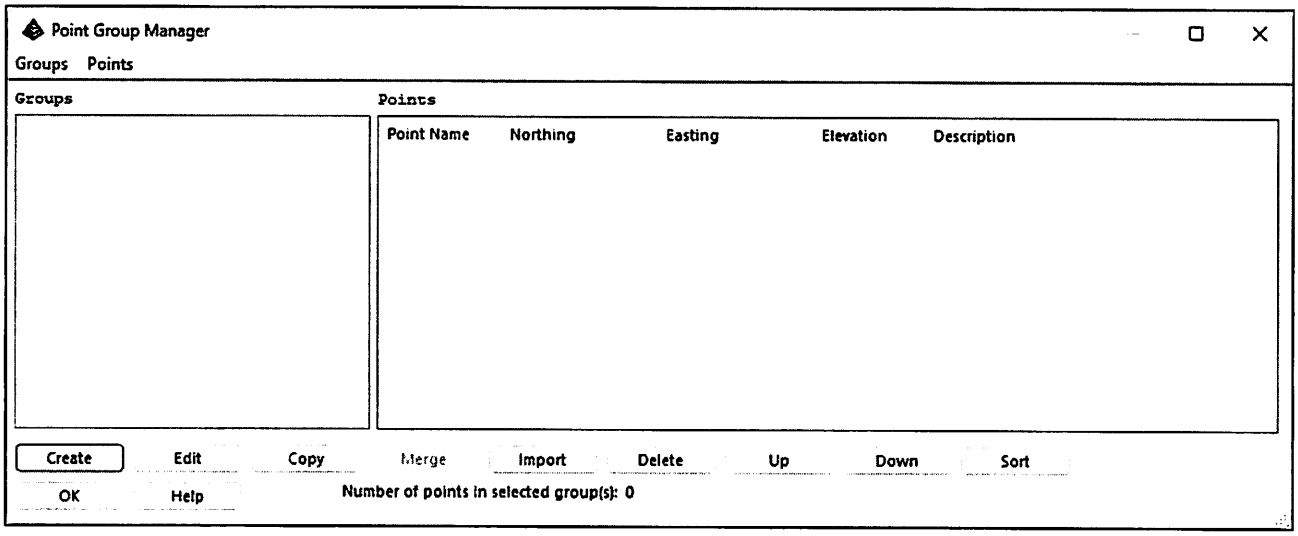
1. Continue working in the drawing **Basemap.dwg**.

If you have not completed the previous lessons:
Open *3_8.dwg* from the project folder *APG 2023 Lesson 3_8*.

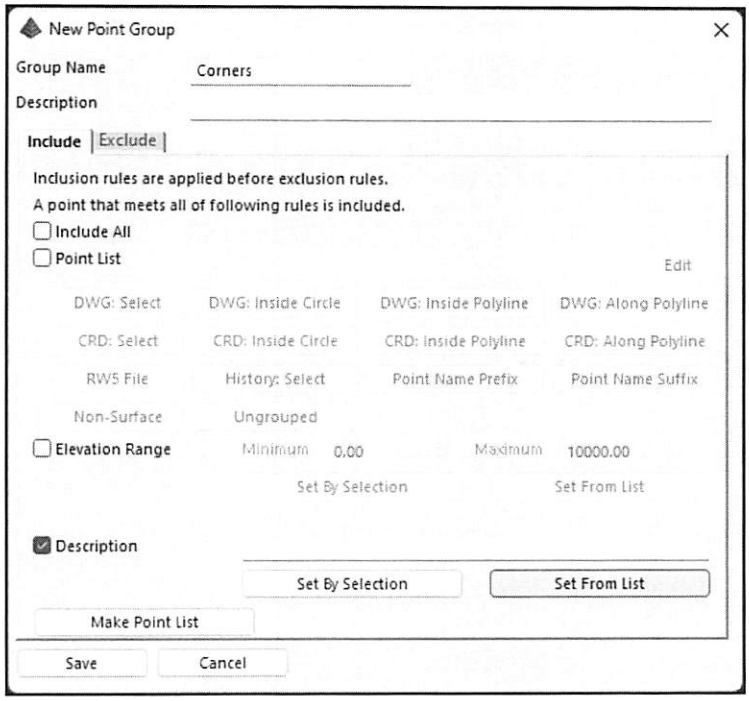
2. Select **Ribbon: Points ⇒ Points ⇒ Group Manager.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Point Group Manager.**

The *Point Group Manager* opens.

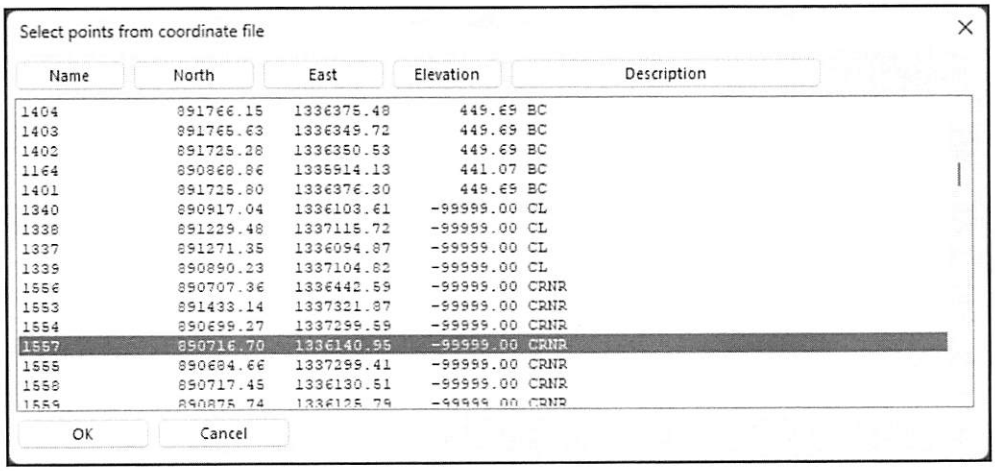


3. Click **<<Create>>**.

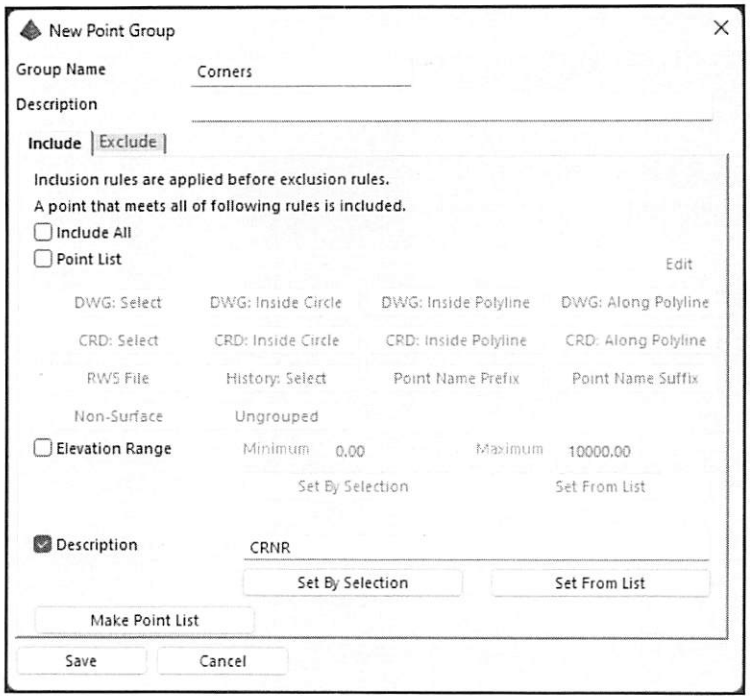


4. In the *New Point Group* dialog box for the **Group Name** enter **Corners**.
5. On the *Include* tab disable **Include All**.
6. Enable **Description**.
7. Click **<<Set From List>>**.

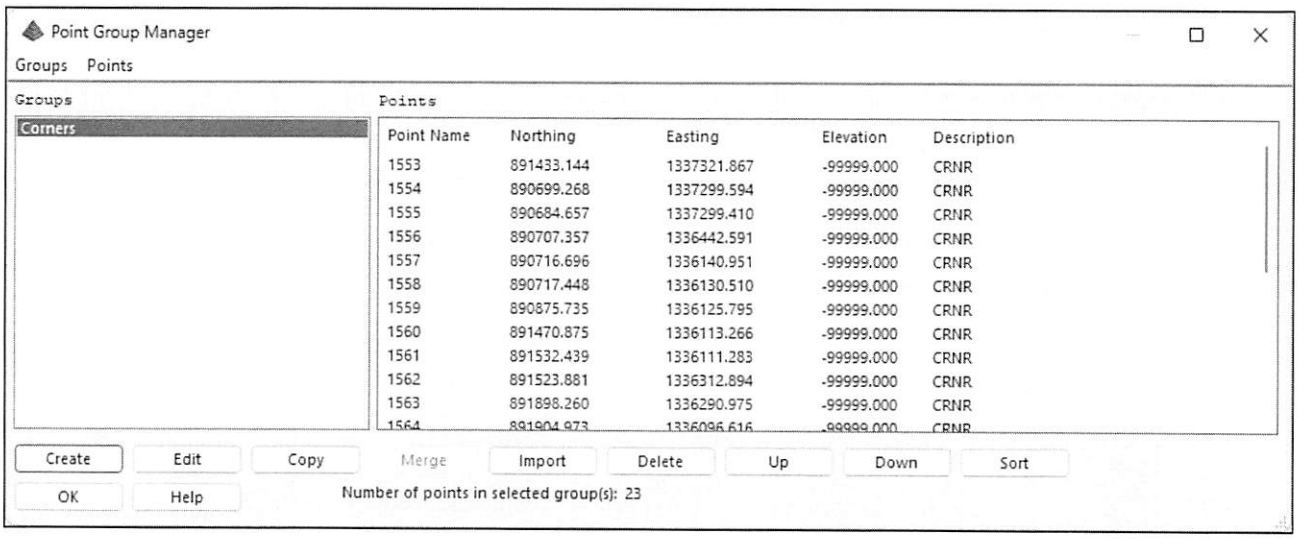
This opens the *Select points from coordinate file* dialog box. Here you can see all the points in the current .CRD file, sort them, and select the descriptions that you want to use to create the point group. It saves time and reduces errors by allowing you to see the description of points that are in the point database so you don't have to type them in from memory.



8. Click **<<Description>>** to sort the list by the description.
9. Find a point with a **CRNR** description and select it.
10. Click **<<OK>>**.



11. Back in the *New Point Group* dialog box click **<<Save>>**.



12. In the *Point Group Manager* notice the new point group Corners. It contains 23 points and is limited to points with the description CRNR.

13. Click **<<OK>>**.

3.8.2 Drawing Points by Point Group

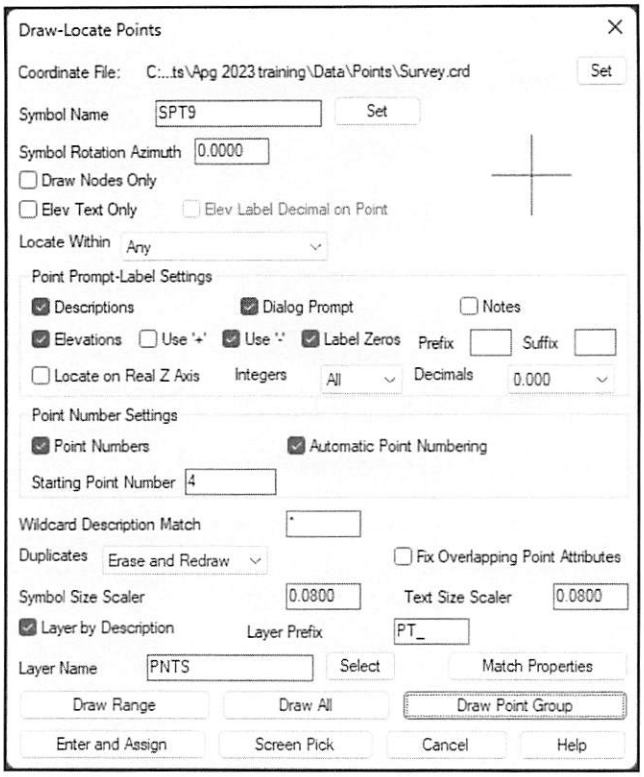
1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu: Select **Points ⇒ Erase Point.**
3. At the command line respond to the prompts as follows:
4. Select points from screen, group or by point number [<Screen>/Group/Number]? **S**
5. Graphically select all the points in the drawing and press **Enter.**
6. Delete points from coordinate file [Yes/<No>]? **N**
7. Delete point symbols, attributes or both [<Both>/Symbols/Attributes]? **B**

All the points are now removed from the drawing, however, they still exist in the point database.

8. Select **Ribbon: Points ⇒ Points ⇒ Draw – Locate Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Draw – Locate Points.**

The *Draw-Locate Points* dialog box opens.



Many of the settings within the *Draw-Locate Points* dialog box are already set to the choices you made in the *Point Defaults* dialog. However, they can be changed here, and the changes will be used for this specific point creation.

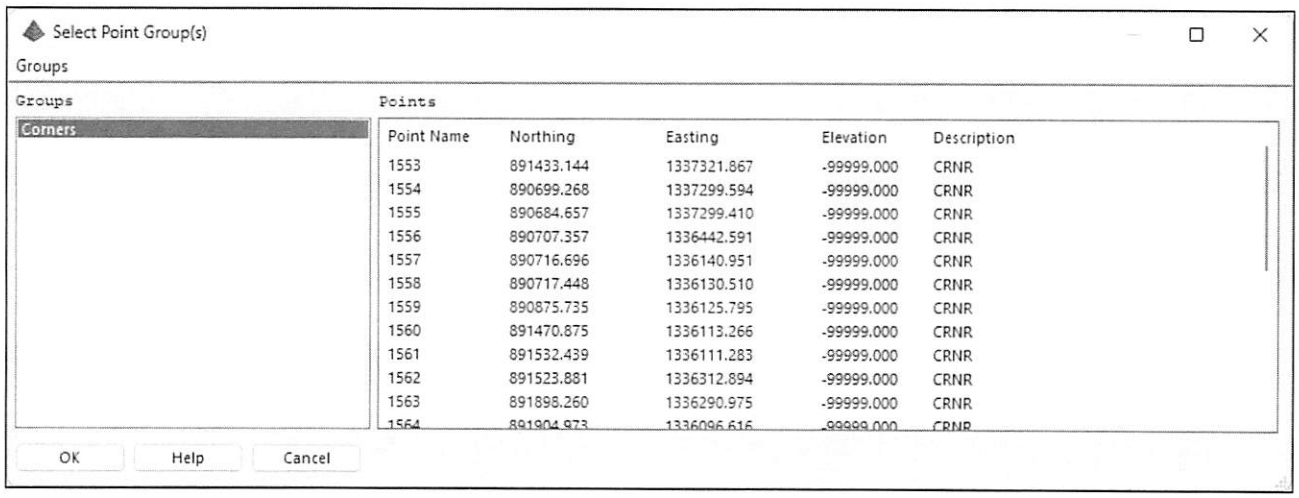
9. Confirm **Layer by Description** is enabled.

10. Confirm the **Layer Prefix** is set to **PT_**.

11. Confirm the remaining settings are set like the graphic above.

12. Click **<<Draw Point Group>>**.

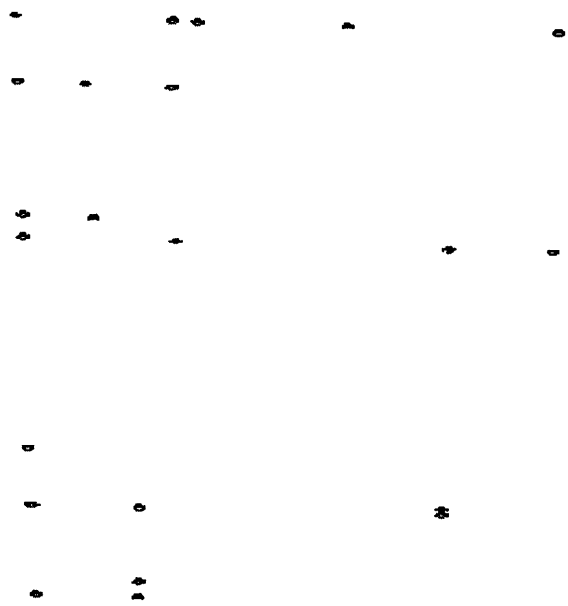
This opens the *Select Point Group(s)* dialog box. Here you can select one or more point groups to draw into the drawing.



13. Confirm the point group **Corners** is selected.

14. Click **<<OK>>**.

Only the points representing corners are created in the drawing and should look like the graphic below.



Lesson Review

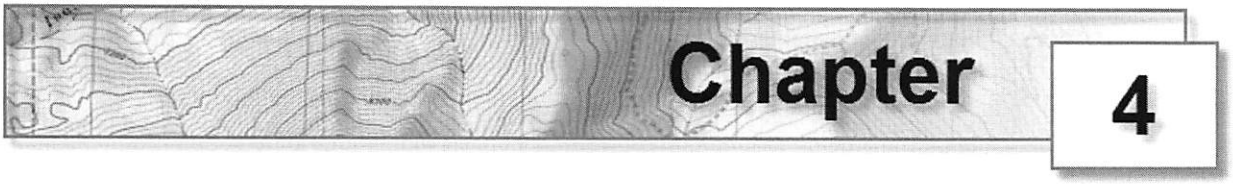
In this lesson you learned about using *Points Groups* in *Carlson Software*. First you created a *Point Group* by including all the points in the .CRD file with a certain description. Then you used that *Point Group* to draw the points into the drawing.

Chapter Review

In this chapter you learned about many aspects of working with points in *Carlson Software*. You looked at the use of the external point database, the coordinate file, known as the Carlson .CRD file. You also learned about several methods for the creation of point blocks in the drawing to represent the records in the external point database. You then learned how to edit the point blocks in the point data, how to erase point blocks and point data.

A solid understanding of the use of points in Carlson is essential. Practice these exercises and try other commands on the points menu that we did not cover. You are on your way to becoming a Carlson Software master and being a master of points is a solid step along the way.

Next we look at creating Surfaces using points and break lines.



4 - Working with Surfaces

Introduction

In this chapter, you are introduced to the theory and practice of working with Surfaces in *Carlson Software*. A solid grasp of the utilization of Surfaces is an essential component of mastering any Survey or Civil Design software, and so is an integral part of *Carlson* as well.

You will learn how to prepare Surface data for processing, how to generate surfaces, edit surfaces, generate contours for surfaces, label contours, how to view surfaces in 3D, and finally how to access information from surfaces.

These concepts are covered in the following lessons.

Lesson: Introduction to Surfaces

In this lesson, you learn what surfaces are and how they are used.

Lesson: Preparing Surface Data

In this lesson you learn how to prepare data for surface modeling.

Lesson: Using Triangulate and Contour

In this lesson, you learn how to use the triangulate and contour command.

Lesson: Working with Contour Labels

In this lesson, you learn how to create contour labels.

Lesson: Viewing Surfaces

In this lesson, you learn how to view surfaces using the Carlson surface viewer.

Lesson: Editing Surfaces

In this Lesson, you learn how to use editing tools to make changes to TINs.

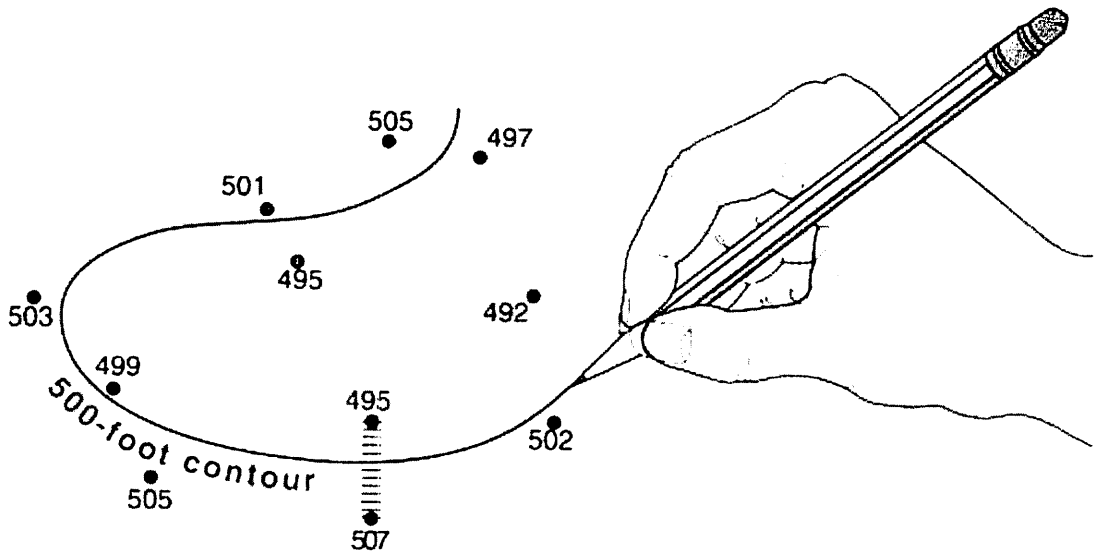
Lesson: Surface Inquiries

In this lesson, you learn how to use several Carlson commands to derive surface information.

4.1 Lesson: Introduction to Surfaces

Introduction

In this lesson we will learn about Surfaces, also known as Digital Terrain Models, or DTM's, and also as TIN's, which are Triangulated Irregular Networks. You will learn what Surfaces are, why they are important, and how *Carlson Software* works with them.



Key Concepts

Concepts and key terms covered in this lesson are:

- What are Surfaces
- Why are they so important in survey work

Objectives

After completing this lesson, you will be able to:

- Describe the importance of Surfaces

A Brief History of Surfaces

Before the introduction of Computer Aided Design and Drafting, or CAD, plans were of course prepared by hand, using drafting tools and media. A critical element of that work was the creation of plans showing the existing topography of sites. The only way to present that information was through contours. Contours are lines of continuous elevation. With practice, a trained eye could look at a map with contours and visualize the surface represented. Areas where contours come closer together represent steeper terrain, and areas with few contours indicate flatter terrain.

Many survey projects involve the careful collection of data on the ground, the representation of that data on a flat sheet, and then subsequent interpolation and interpretation of that data to generate a topographic base map with contours to visually describe the site to others. There was a true art form to this entire process, and though the methodology has changed dramatically over the last 30 years, there is still a lot of art and science involved in the current methods used to get to the same result.

One significant change in the process described is that in addition to the creation of a contoured plan view of a site, a digital model of the topography, is also generated for a variety of uses including; volume calculations, section and profile generation, visualizations of existing conditions and civil design proposed improvements to the site, and more and more commonly today, machine controlled grading of the actual site.

For these reasons, digital Surfaces are essentially the fundamental building blocks and common currency of the modern survey, civil engineering, construction and machine control trades.

Lesson Review

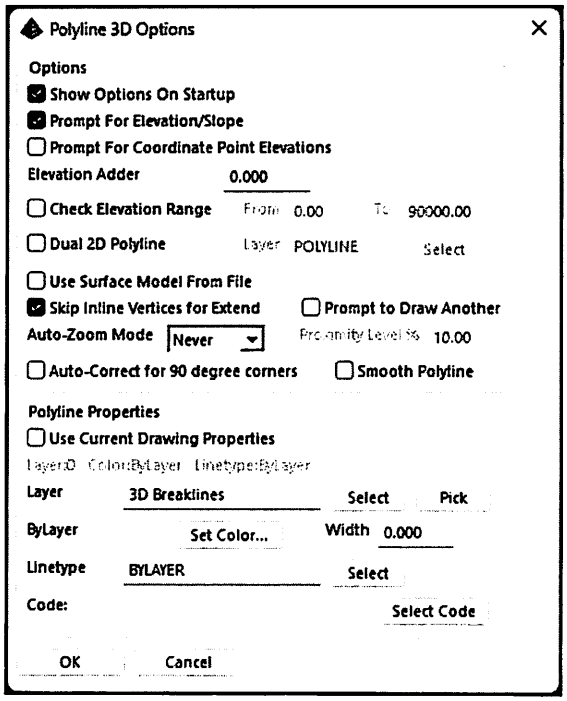
In this lesson, you learned some of the history of surface modeling, and the importance of surface modeling to surveying and civil engineering work.

Now let's learn how *Carlson* generates Surfaces and utilizes them.

4.2 Lesson: Preparing Surface Data

Introduction

In this lesson we look at the types of data used to generate Surfaces and how to prepare them for consumption.



Key Concepts

Concepts and key terms covered in this lesson are:

- Types of Surface Data
- Preparing a drawing for Surface Creation

Objectives

After completing this lesson, you will be able to:

- Describe the fundamental types of Surface Data
- Prepare a drawing for Surface Creation

Surface Data Types

There are three types of data that can be used to generate surfaces. Though they are sometimes referred to by a variety of names, they are essentially points, faults and contours.

Points

Points are single locations, coordinates with horizontal and vertical data. We have learned in a previous chapter how to work with point data, and how to generate blocks in a drawing to represent that data.

Faults

Faults are also commonly referred to as breaklines, and are linear features on a site, represented in Carlson drawing files by 3D Polylines, which are polylines that travel through three-dimensional space, changing elevation from vertex to vertex. Typical features represented by breaklines are edges of pavement, centerlines of pavement, flowlines of ditches, tops of banks, toes of slopes, and curbs and gutters.

Contours

Contours, as mentioned earlier, are lines of constant elevation. They are typically represented in drawings as 2D Polylines at the correct elevation. They do not change elevation from vertex to vertex. While contours are generated by the software from Surfaces, contours are also often used as a data source to create a Surface.

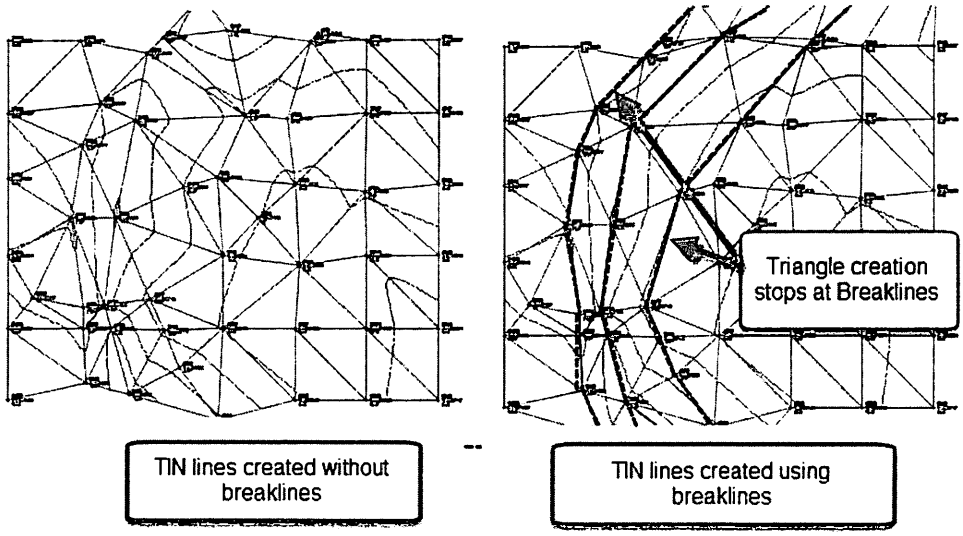
Manual and Automatic Breakline Generation

Carlson Survey contains a feature called *Field to Finish* that allows the automatic generation of 3D breaklines directly from field data. The implementation of *Field to Finish* is not discussed in this book; it is covered in detail in *A Practical Guide to Carlson Survey*. However, breaklines are typically necessary to generate an accurate surface model and subsequent contours. In this lesson we will manually connect points that represent breaklines on the site.

The reason these features are represented by breaklines, as opposed to simply point data, is to force the triangulation of the surface to occur between specific data points to better and more accurately represent the surface.

Breakline Generation

Breaklines are essentially 3D polylines placed in the drawing to control the creation of the surface triangles between the point data. Sharp changes in the surface such as top and bottom of curbs, retaining walls, or top and bottom of a slope are all examples where breaklines may be implemented.



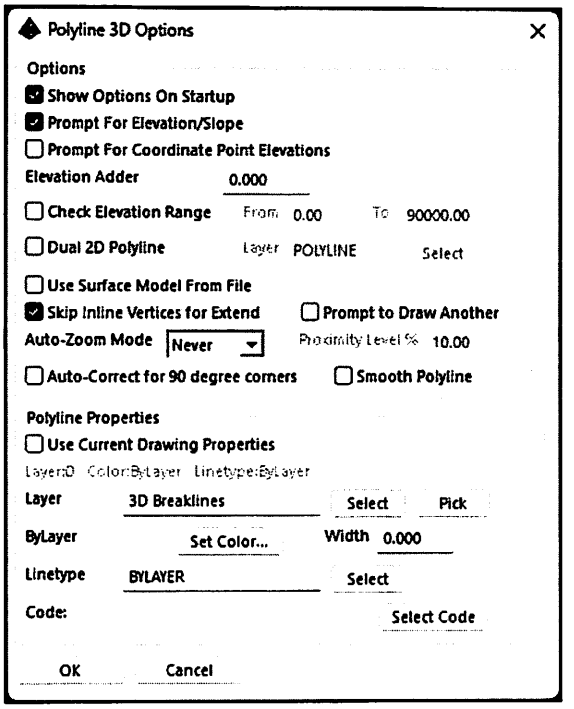
Breaklines can be generated in an automated fashion through the use of specific field coding but can also easily be added to a drawing by simply drawing 3D polylines and adding them to your selection set when creating a surface model.

Drawing 3D Polylines

One method to add geometry to a drawing to represent linear features on a site is to manually create 3D Polylines. These can be drawn from point to point, or without the use of points. 3D Polylines are specific CAD entities that move through three-dimensional space, that is to say, the elevation at the vertices varies.

Polyline 3D Options

There are quite a few options in the dialog box presented at the execution of the Carlson 3D Polyline command, also known by its command line name, 3DP. They all control how this command is executed. They are elaborated on as follows:



Show Options on Startup

Show Options on Startup determines whether this dialog box is presented for review every time the command is invoked.

Prompt for Elevation/Slope

Prompt for Elevation/Slope determines whether or not you are prompted at the command line to confirm or enter elevations for each vertex as it is defined.

Prompt for Coordinate Point Elevations

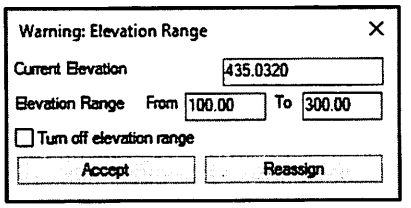
If Prompt for Coordinate Point Elevations is selected, when you enter a point number to draw a 3D Polyline vertex to, the elevation of the point is read from the .CRD and presented to you at the command line to confirm or change to another elevation. When unselected, the elevation for the point as stored in the database is used without your review.

Elevation Adder

This adds the amount specified to all elevations entered or read from the database.

Check Elevation Range

When selected, all elevations entered or read from the database are checked against the range specified. If they are outside the specified range you are notified.



Use Surface Model From File

This options employs the use of a Surface model, stored as an external file, such as a .TIN, to provide the elevation of the vertex being set.

Auto Zoom

This determines if and how the screen view follows you as you create the 3D Polyline.

Polyline Properties

These settings determine if the current drawing CAD settings are used when creating the new 3D Polyline, such as layer and color, or if they are overridden.

Exercises: Make a Point Group, Isolate it, and Connect the Points with 3D Polylines

In these exercises you create a Point Group specifically to isolate a set of Points to be used to generate 3D Polylines connecting them. The 3D Polylines are used as breaklines to produce more accurate Surface Modeling.

You do the following:

- Create a new drawing and associate it with the existing CRD file
- Create a Point Group
- Draw only those Points
- Connect them with 3D Polylines

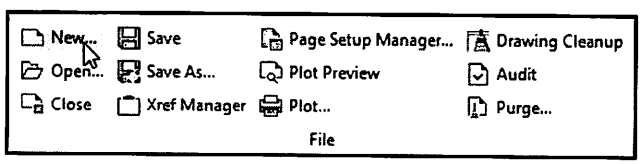
4.2.1 Creating a New Drawing for the Surface

In this exercise you will create a new drawing where you will build the surface and draw contours. This drawing will be associated with the existing survey.crd file that you have used in previous exercises.

If you skipped previous lessons and do not have the *Training* project to use, you will create a new drawing called **Surface.dwg** in the **C:\Carlson Projects\APG 2023 Lesson 4_2\DWGS** folder, and associate it with the **survey.crd** in the **C:\Carlson Projects\APG 2023 Lesson 4_2\Data\Points** folder.

NOTE: Instructions for Downloading and Installing the Datasets can be found on page vi.

1. Select **Ribbon: File ⇒ File ⇒ New.**

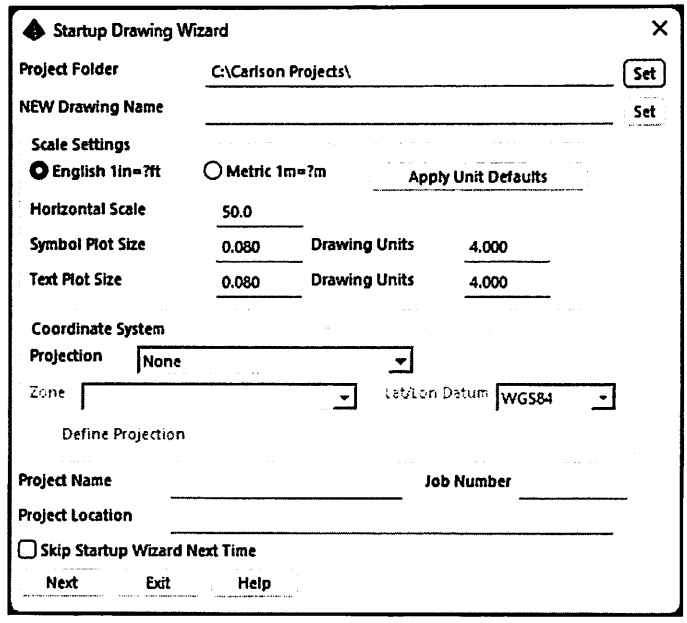


Alternatively, from the pull-down menu:
Select **File ⇒ New.**

2. Select the drawing template **carlson23.dwt** and click **<<Open>>.**

Note: Depending on the version of Carlson you have installed, the default template may have a different name. (ie. Surv.dwt or Carlson.dwt). In any case, the extension to the file name will be .DWT. A discussion on employing a user defined template appears later in this book.

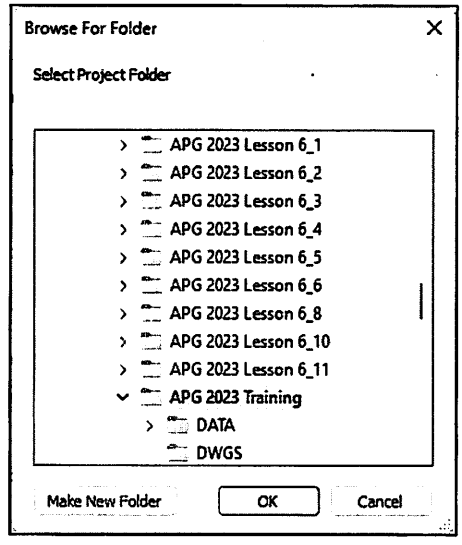
3. Click **<<Set>>** next to **Project Folder**.



Note: if you choose to use either the *Drawing Folder* or a *Fixed Folder* options to store your project data, you will not see the prompt for a project folder in the startup wizard.

This opens the *Select Project Folder* dialog box. Here, you can either select an existing project folder or create a new one.

4. Select the folder **C:\Carlson Projects\APG 2023 Training.**

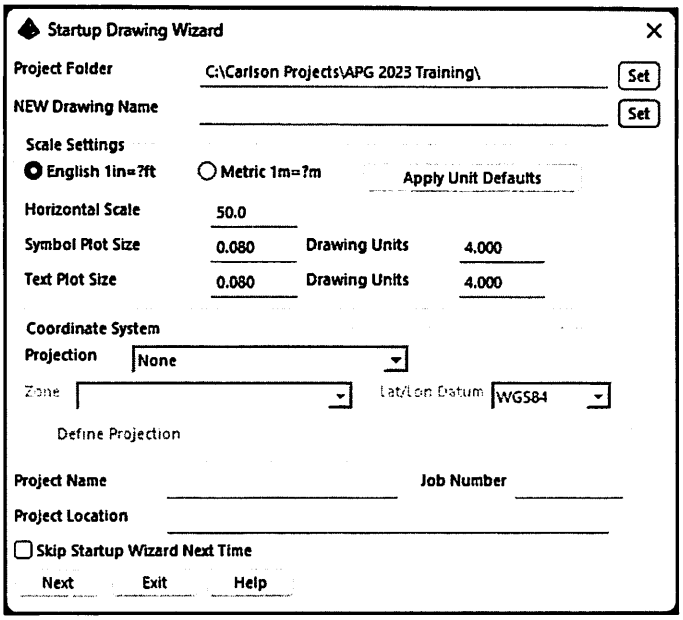


If you skipped previous lessons and do not have this project select: **C:\Carlson Projects\APG 2023 Lesson 4_2**

The project folder is often set to a shared network location. For training purposes we are setting it local on the C drive.

5. Click **<<OK>>**.

6. Back in the *Startup Drawing Wizard*, click **<<Set>>** next to **NEW Drawing Name.**



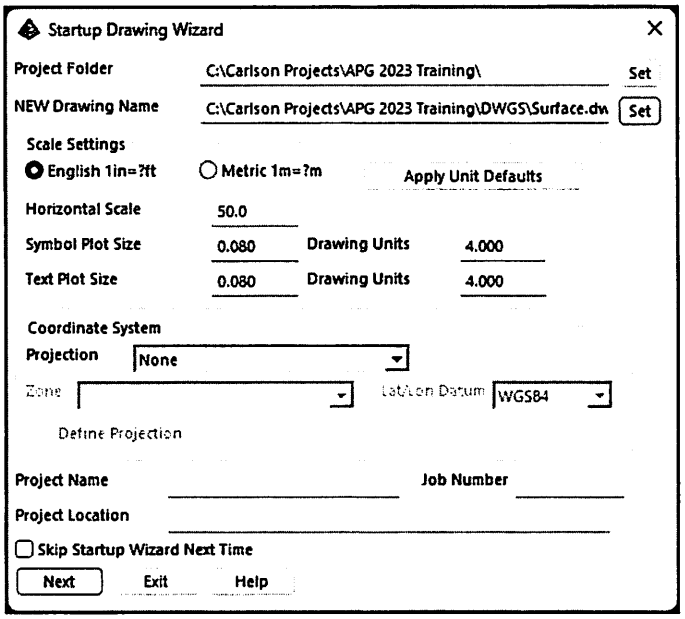
The new drawing location defaults to the DWGS folder inside the newly created project folder. This is because you selected the CSW folder assignments in a previous lesson. You are allowed to save the drawing in any location you wish. Carlson Software does not have any restrictions on the locations drawings are saved. However, if you are using the Project method for organization of your work, it is beneficial to keep the drawings in the DWG folder in the Project.

7. Name the drawing **Surface** and click **<<Save>>**.

8. Back in the *Startup Drawing Wizard*, confirm the units are set to **English**.

9. Confirm the **Horizontal Scale** is set to **50**.

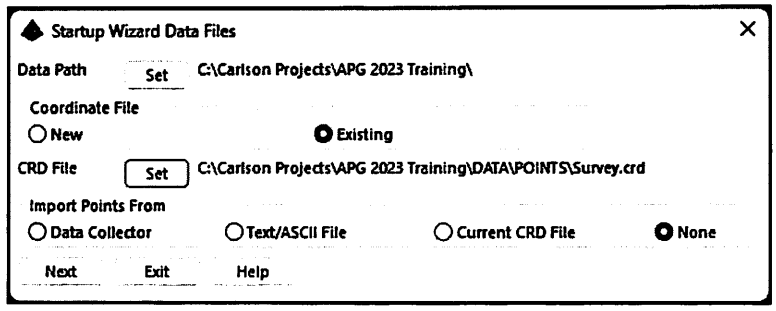
10. Click **<<Next>>**.



This opens the *Startup Wizard Data Files* dialog box.

11. First, set the **Coordinate File** to **Existing**.

12. Then click **<<Set>>** next to **CRD File.**



It is important that you select the *Existing* option in the *Coordinate File* section before you click *<<Set>>*. This changes the dialog box that opens when you click *<<Set>>* from New to Existing.

13. In the *Coordinate File to Open* dialog box, Browse and select: **C:\Carlson Projects\APG 2023 Training\Data\Points\Survey.crd**

If you have skipped previous lessons and did not create the .CRD file you can browse for a copy: **C:\Carlson Projects\APG 2023 Lesson 4_2\Data\Points\Survey.crd**

You are associating the CRD file that you have been using in previous exercises with this new drawing. This is common when you have a job that require more than one drawing and you need to share and access the data from all drawings.

14. Click **<<Open>>**.

15. Back in the *Startup Wizard Data Files* dialog box confirm the **Import Points From** option is set to **None**.

16. Click **<<Next>>** to complete the *Startup Drawing Wizard.*

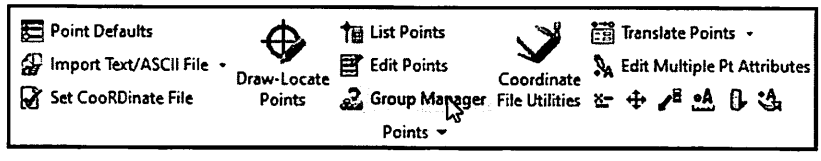
You now have a new, empty drawing that is associated with the Survey.CRD file. Next you will prepare your surface data, build a surface, and draw contours in this drawing.

4.2.2 Creating a Point Group to Be Used as Surface Data

Before you create the surface you can create a *Point Group* that will be used to select only the points that you want to use for the surface data. Points that should not be included in the surface should not be included in the point group. Points for utility potholes or points that are part of the project for horizontal control and do not have accurate surface elevations are examples of points that should not be included in this group.

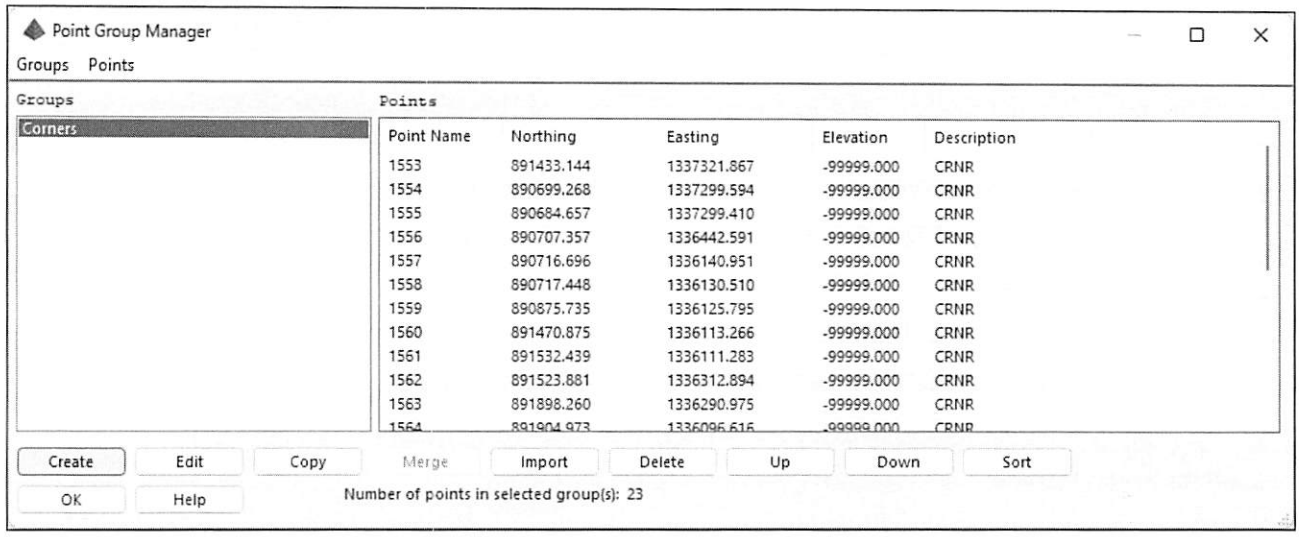
1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Points ⇒ Points ⇒ Group Manager.**

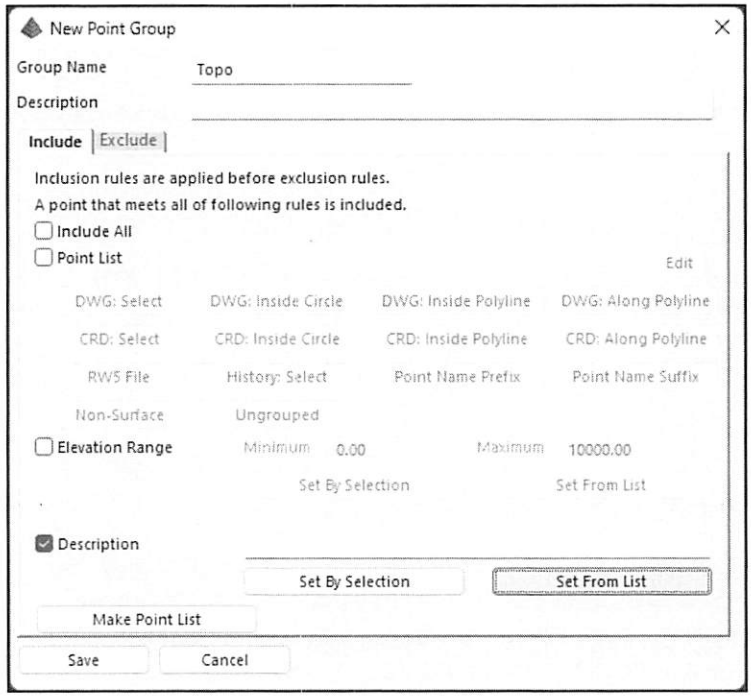


Alternatively, from the pull-down menu:
Select **Points ⇒ Point Group Manager.**

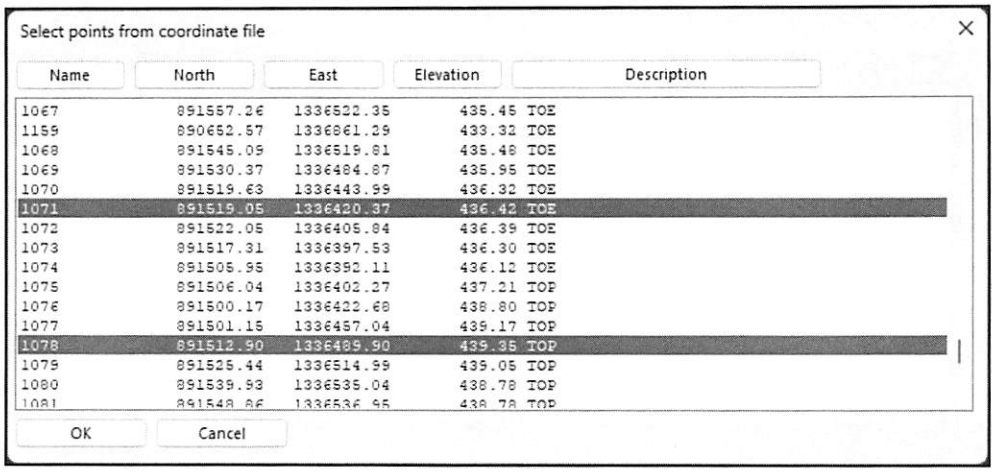
The *Point Group Manger* opens.



3. Click **<<Create>>**.


New Point Group
Group Name Topo
Description
Include Exclude
Inclusion rules are applied before exclusion rules.
A point that meets all of following rules is included.
Include All
Point List
Edit
DWG: Select DWG: Inside Circle DWG: Inside Polyline DWG: Along Polyline
CRD: Select CRD: Inside Circle CRD: Inside Polyline CRD: Along Polyline
RWS File History: Select Point Name Prefix Point Name Suffix
Non-Surface Ungrouped
Elevation Range Minimum 0.00 Maximum 10000.00
Set By Selection Set From List
Description
Set By Selection Set From List
Make Point List
Save Cancel

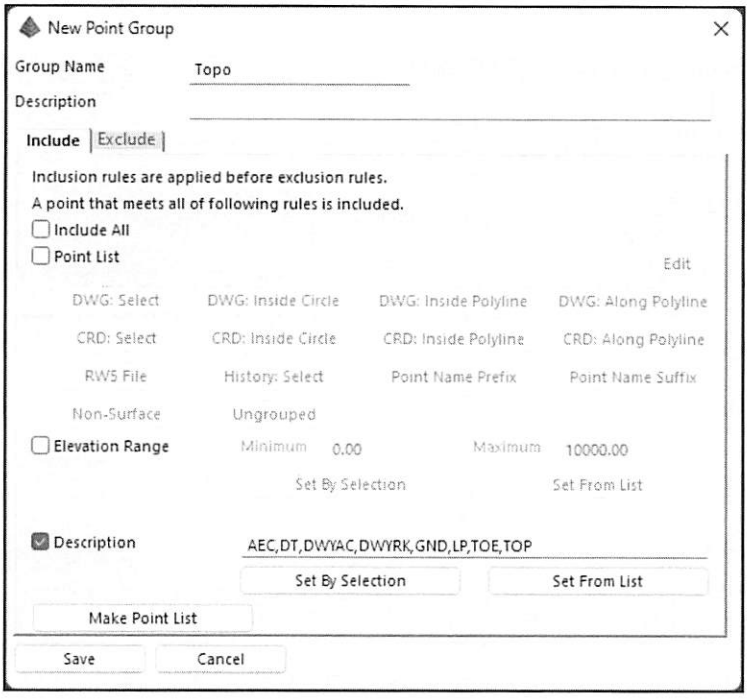
4. In the *New Point Group* dialog box for the **Group Name** enter **Topo**.
5. On the *Include* tab disable **Include All**.
6. Enable **Description**.
7. Click **<<Set From List>>**.



8. Click **<<Description>>** to sort the list by the description.

9. While pressing the **Ctrl** key select points with the descriptions **AEC, DT, DWYAC, DWYRK, GND, LP, TOE,** and **TOP**.

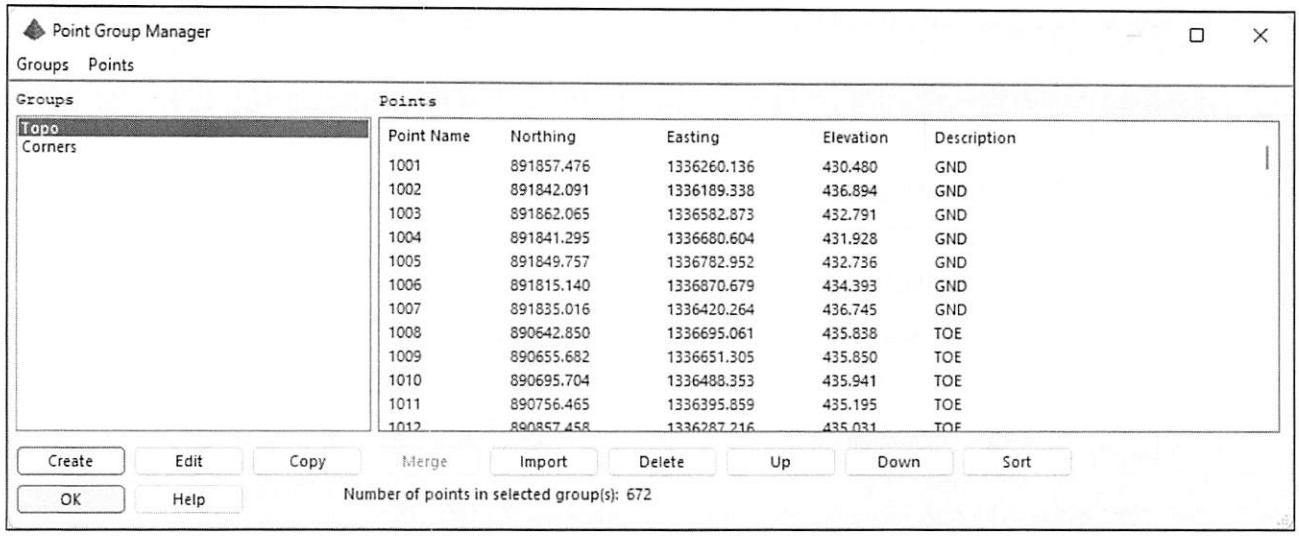
10. Click **<<OK>>**.



11. Back in the *New Point Group* dialog box notice the list of descriptions separated by commas.

If you know the descriptions you could just type them in manually rather than selecting them from the list.

12. Click **<<Save>>**.



13. In the *Point Group Manager* notice the new point group **Topo**.

14. Click **<<OK>>**.

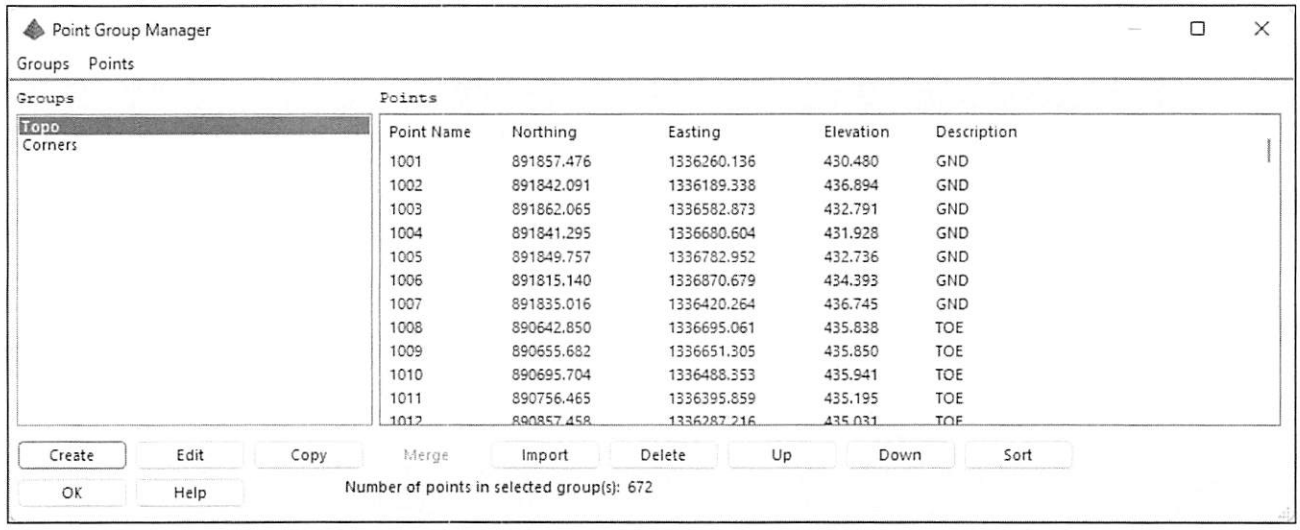
4.2.3 Creating a Point Group to Connect with 3D Polylines

1. Continue working in the drawing from the previous exercise.

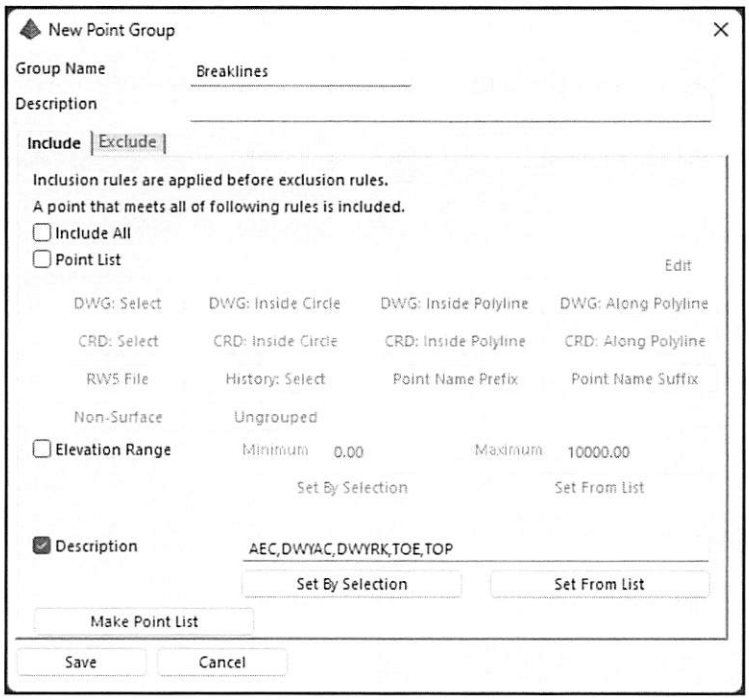
2. Select **Ribbon: Points ⇒ Points ⇒ Group Manager.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Point Group Manager.**

The *Point Group Manger* opens.



3. Click **<<Create>>**.



4. In the *New Point Group* dialog box for the **Group Name** enter **Breaklines**.

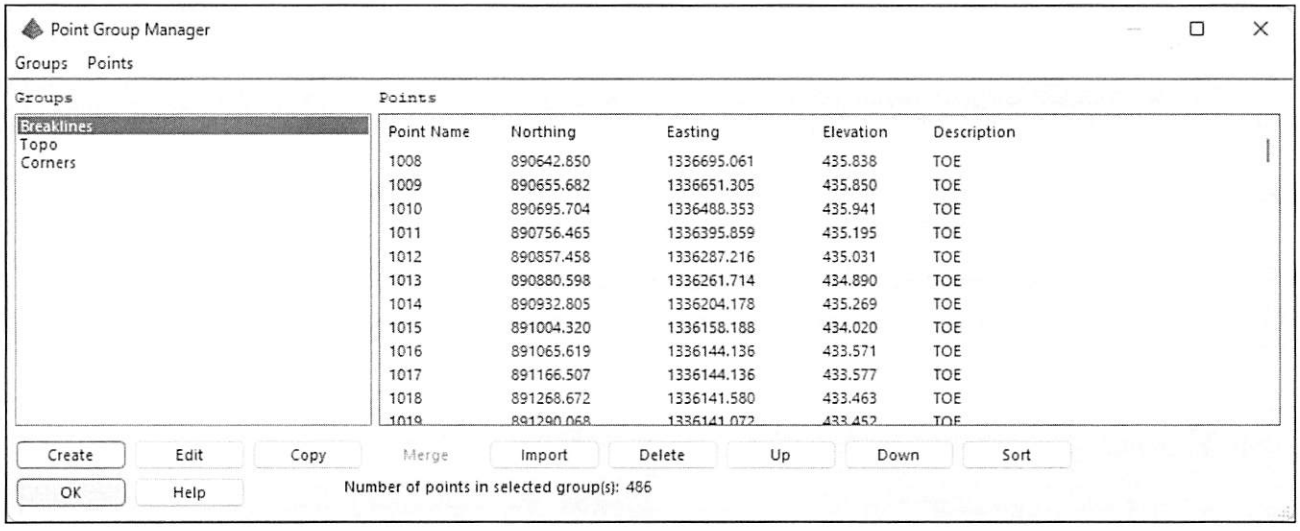
5. On the *Include* tab disable **Include All**.

6. Enable **Description**.

7. In the **Descriptions** field enter **AEC, DWYAC, DWYRK, TOE, TOP.**

There should be no spaces after the commas before the next code. You could also click *<<Set From List>>* to select the descriptions graphically.

8. Click **<<Save>>**.



9. In the *Point Group Manager* notice the new point group **Breaklines**.

10. Click **<<OK>>**.

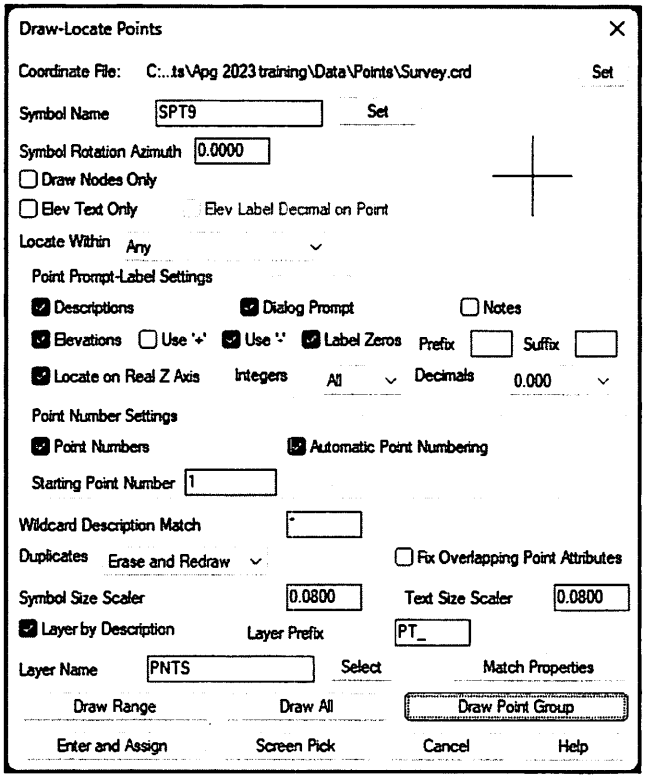
4.2.4 Drawing 3D Polylines by Point Number

1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Points ⇒ Points ⇒ Draw – Locate Points.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Draw – Locate Points.**

The *Draw-Locate Points* dialog box opens.



3. Set the **Symbol Name** to **SPT9**.

4. Enable **Locate on Real Z Axis**.

If you want to connect points using standard CAD drawing commands, with a NODE Osnap, to create 2D linework for a planimetric (2D/flat) basemap, draw the points with *Locate on Real Z Axis* disabled.

If you want to connect points with a standard CAD 3D Polyline command, using the NODE Osnap, to create 3-dimensional geometry, enable *Locate on Real Z Axis*.

If you use the Carlson special 2D Polyline or 3D Polyline commands, and specify points by point number, it does not matter if they are drawn with *Locate on Real Z Axis* enabled or disabled.

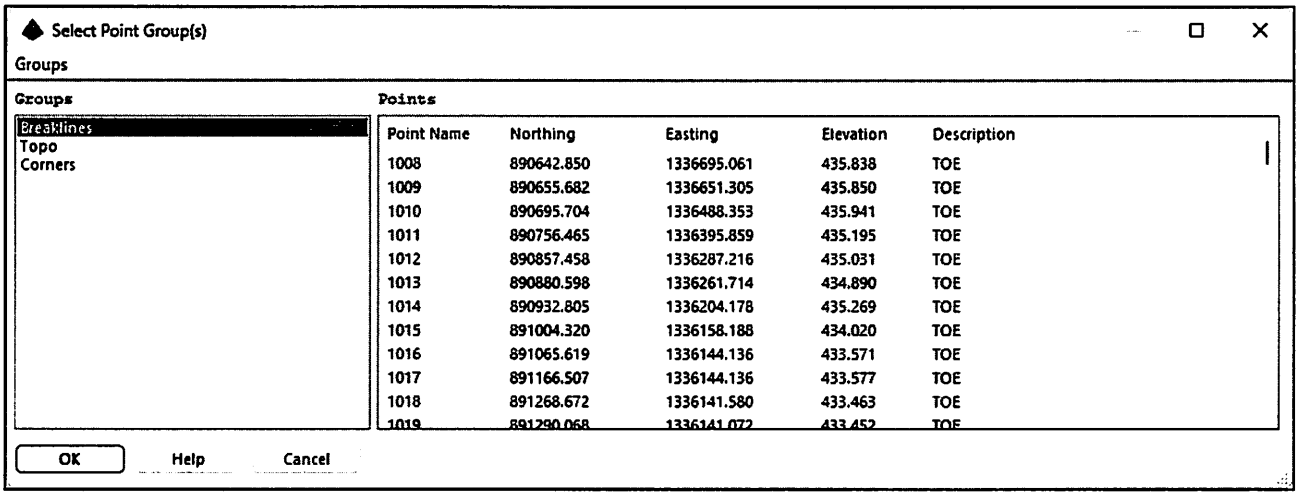
5. Confirm **Layer by Description** is enabled.

6. Confirm the **Layer Prefix** is set to **PT_**.

7. Confirm the remaining settings are set like the graphic above.

8. Click **<<Draw Point Group>>**.

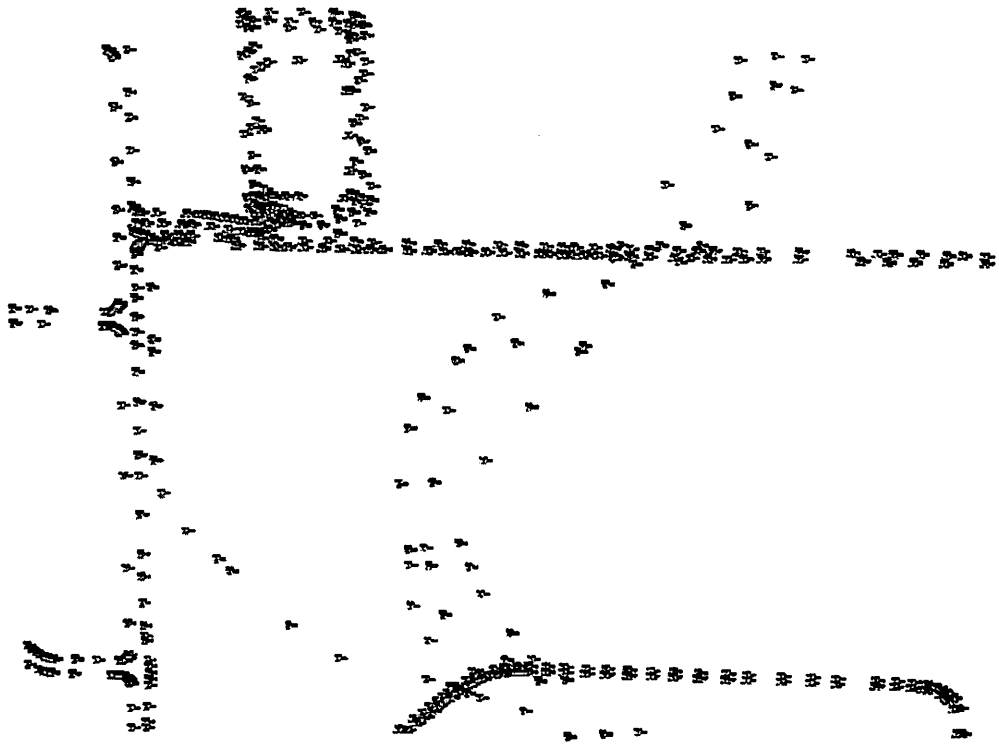
This opens the *Select Point Group(s)* dialog box. Here you can select one or more *Point Groups* to draw into the drawing.



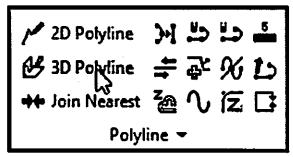
9. Select the point group **Breaklines**.

10. Click **<<OK>>**.

The points in the Breaklines group are now drawn into the drawing. The drawing should look like the graphic below.

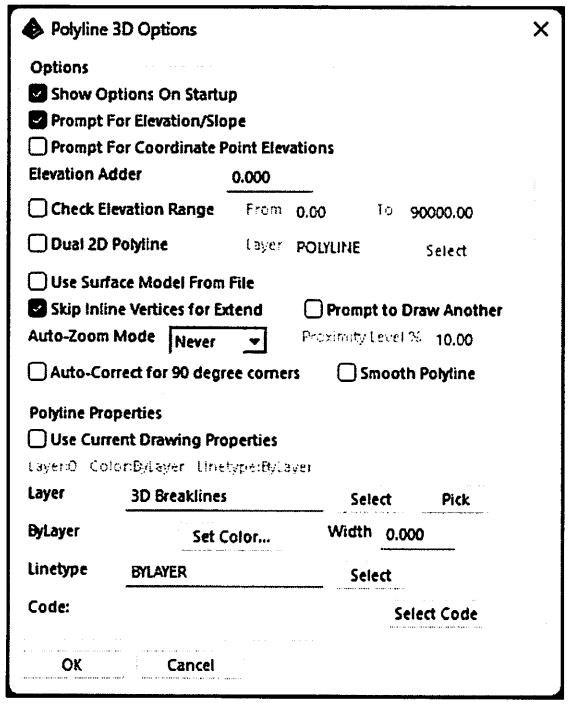


11. Select **Ribbon: Draft ⇒ Polyline ⇒ 3D Polyline.**

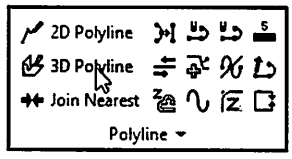


Alternatively, from the pull-down menu:
Select **Draw ⇒ 3D Polyline.**

12. In the *Polyline 3D Options* dialog box confirm **Prompt For Elevation/Slope** is enabled.
13. Disable **Use Current Drawing Properties.**
14. For the **Layer** enter **3D Breaklines.**
15. Click **<<OK>>.**



16. At the command line enter: **1408-1447** and **Enter** to draw the line.
17. **Enter** again to end the line and the command.
18. Select **Ribbon: Draft ⇒ Polyline ⇒ 3D Polyline.**



Alternatively, from the pull-down menu:
Select **Draw ⇒ 3D Polyline.**

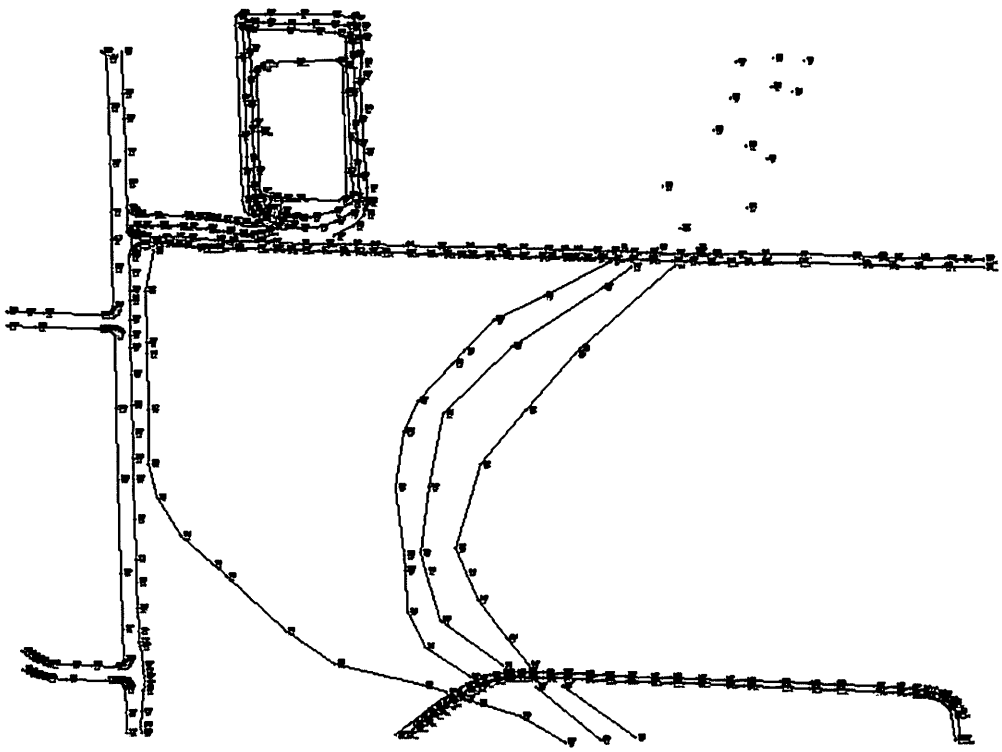
You can also just *Enter* to start the command again. This can be faster if you have several lines to draw as we do in this exercise.

19. In the *Polyline 3D Options* dialog box the settings will be retained from the last time you ran the command. Click **<<OK>>.**

20. Use the points in the following list of points to draw the breaklines the same way that you drew the previous line. Be sure to **Enter** after each group of point numbers to end the line. You will need to restart the **3D Polyline** command for each line. (Note: you will need to press Enter four times between each set of point numbers.)

Point Numbers
1448-1486
1008-1021
1191-1209
1226-1257
1258-1278
1281-1324
1295,1661-1710
1622-1660,1294
1286,1348-1398,1287
1022-1074
1075-1105
1155-1158
1159-1160
1153-1154
1143-1152
1130-1142
1121-1129

The new breaklines will look like the graphic below.

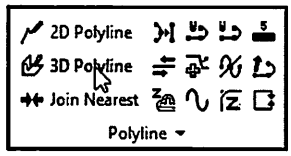


4.2.5 Drawing 3D Polylines by Point Selection

1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu: Select **View ⇒ Zoom ⇒ Zoom Point(s)**.
3. At the command line respond to the prompts as follows:
4. Find by point number or description [<Number>/Desc]? **N**
5. Point number or range of point numbers to find <1>: **1110**
6. Magnification or Height < 80.2>: **150**
7. From the pull-down menu: Select **Settings ⇒ Point Object Snap On/Off.**

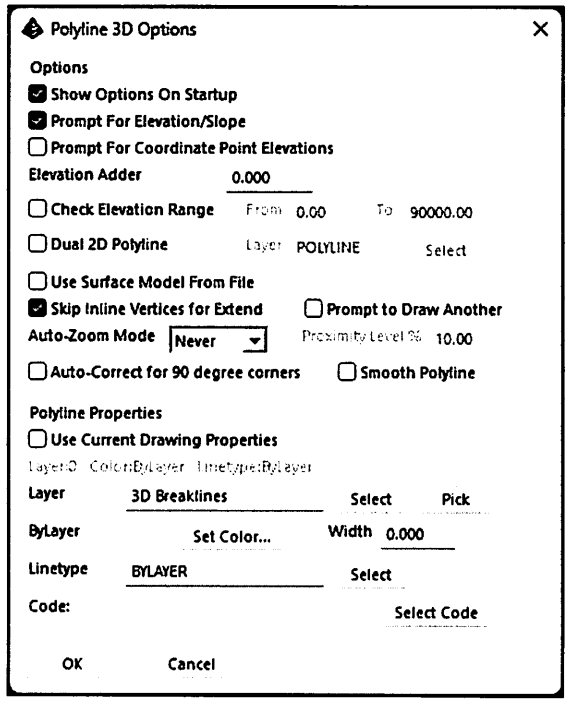
The command line should display: **Point Object Snap ON**

8. Select **Ribbon: Draft ⇒ Polyline ⇒ 3D Polyline.**



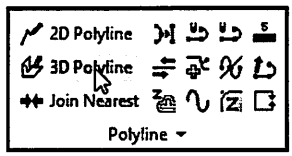
Alternatively, from the pull-down menu:
Select **Draw ⇒ 3D Polyline.**

9. In the *Polyline 3D Options* dialog box confirm **Prompt For Elevation/Slope** is enabled.
10. Confirm the **Layer** is set to **3D Breaklines**.
11. Click **<<OK>>**.



12. Using the *Carlson Point Object Snap* that you just enabled, pick point **1110** from the screen.
13. When prompted to confirm the elevation press **Enter**.
14. Pan north, then pick points **1109, 1108, 1107, and 1106** to draw a breakline between the TOP points toward the northeast corner of the site. When prompted to confirm the elevation of each point press **Enter**.
15. **Enter** to end the line and the command.

16. Select **Ribbon: Draft ⇒ Polyline ⇒ 3D Polyline.**



Alternatively, from the pull-down menu:
Select **Draw ⇒ 3D Polyline.**

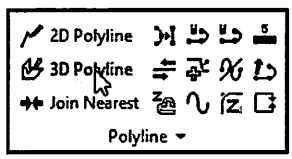
You can also just *Enter* to start the command again. This can be faster if you have several lines to draw as we do in this exercise.

17. In the *Polyline 3D Options* dialog box the settings will be retained from the last time you ran the command. Click **<<OK>>**.

18. Starting at point **1116,** define a second breakline along the bottom of the ditch using points **1116, 1117, 1118, 1119**, and **1120**. When prompted to confirm the elevation of each point press **Enter**.

19. **Enter** to end the line and the command.

20. Select **Ribbon: Draft ⇒ Polyline ⇒ 3D Polyline.**



Alternatively, from the pull-down menu:
Select **Draw ⇒ 3D Polyline.**

You can also just *Enter* to start the command again. This can be faster if you have several lines to draw as we do in this exercise.

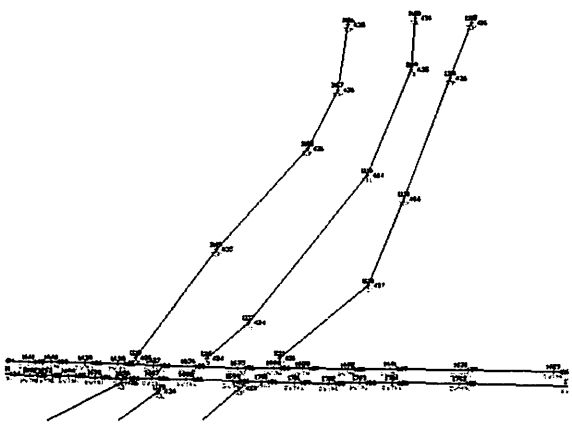
21. In the *Polyline 3D Options* dialog box the settings will be retained from the last time you ran the command. Click **<<OK>>**.

22. Starting at point **1111,** define a third breakline along the bank of the ditch using points **1111, 1112, 1113, 1114**, and **1115**. When prompted to confirm the elevation of each point press **Enter**.

23. **Enter** to end the line and the command.

The three new breaklines will look like the graphic below. They will be used as break lines to create a more accurate surface model.

Notice that these new breaklines are created so as not to cross the previously created breaklines running horizontally connecting the DWYRK points. Crossing breaklines are a violation of TIN modeling rules and will be captured by the surface modeling program and presented to you for correction.



24. From the pull-down menu: Select **Settings ⇒ Point Object Snap On/Off.**

The command line should display: **Point Object Snap OFF**

Lesson Review

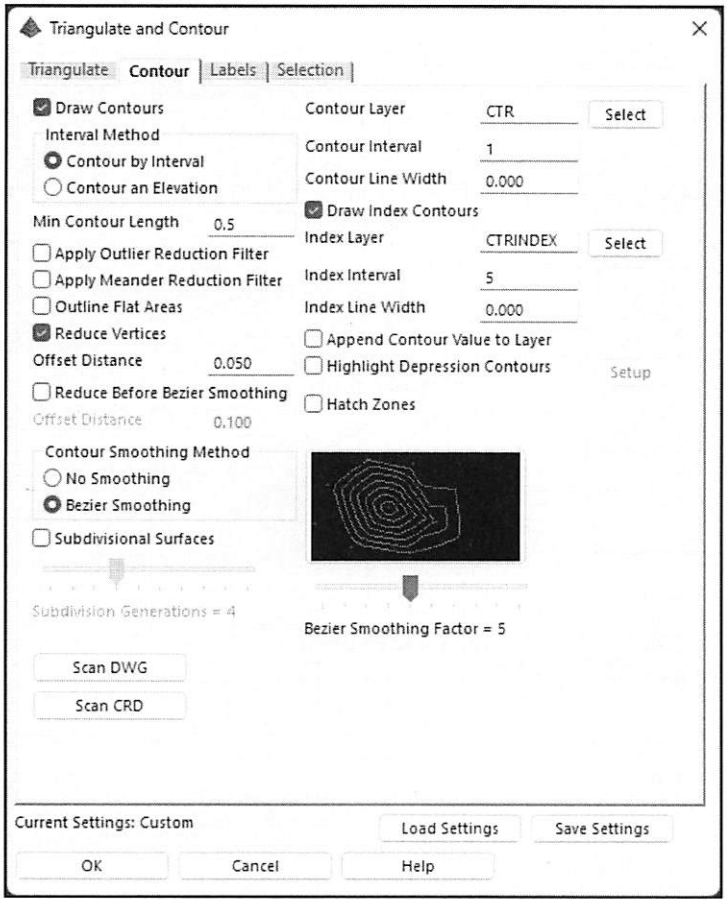
In this lesson, you learned about different types of Surface Data, and how to prepare a drawing for Surface Generation. You started by creating a Point Group for the breaklines and for all surface related data. You then displayed only the points from the breakline group in the drawing and connected them with 3D polylines both by entering lists of point numbers and by graphically selecting the points. Now you have all the date prepared and are ready to use the Triangulate and Contour command in the next lesson.

4.3 Lesson: Using Triangulate and Contour

Introduction

The *Carlson Triangulate and Contour* command combines the tasks of forming a triangulated network from the provided data, writing an external TIN file, generating contours, and labeling surface contours.

These tasks are divided into tabs in the *Triangulate and Contour* dialog box. There are a variety of settings available to customize the process. We will address a minimal number of critical settings to get through the process successfully.



Key Concepts

Concepts and key terms covered in this lesson are:

- Using Triangulate and Contour
- The layout of the Triangulate and Contour Dialog Box

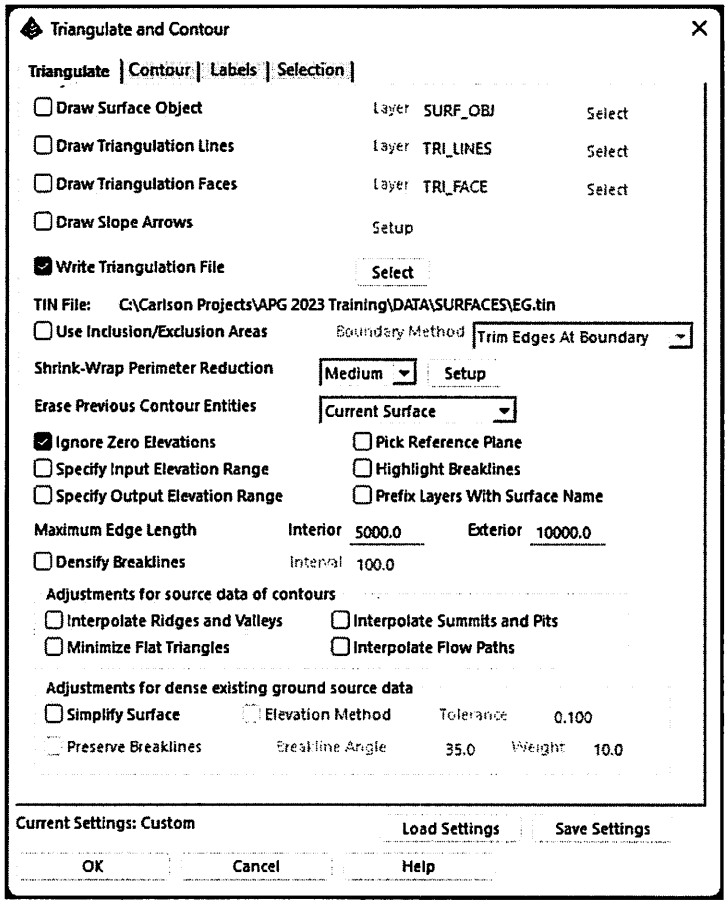
Objectives

After completing this lesson, you will be able to:

- Successfully Utilize the Triangulate and Contour Feature

Triangulate Tab

The *Triangulate* tab contains settings controlling the triangulation process, including the drawing of features, storing of external data, and triangulating algorithm options.



Draw Surface Object

This option draws the newly generated TIN as a Carlson Surface Object. These are designed to be used for visualizations and editing of very large surfaces.

Draw Triangulation Lines

This option draws the newly generated TIN as 3D Lines.

Draw Triangulation Faces

This option draws the newly generated TIN as 3D Faces. These can be shaded and rendered and are useful for surface visualization. However, the *Surface 3D Viewer* does not require these 3D Faces to visualize a surface, it works directly from the .TIN file.

Draw Slope Arrows

This option generates arrows for each TIN triangle indicating the direction of slope of each.

Write Triangulation File

This option writes the newly generated TIN as an external .TIN File.

Use Inclusion/Exclusion Areas

Carlson software calls a boundary around the perimeter of a Surface dataset an Inclusion Perimeter, and it prevents the creation of any Surface area from taking place outside of it. The most common application of this feature is to prevent triangulation from occurring where

there is no data, by triangulation lines of interpolation "jumping" across empty areas at the extremities of the dataset.

An Exclusion Area or Perimeter is most typically an area within the Surface that you do not wish triangulation to take place, most commonly within building footprints, or water bodies, such as ponds or lakes.

If you have Inclusion or Exclusion Perimeters defined, that you wish to use in the Triangulate and Contour function, you would select this option. When you proceed from the entire Triangulate and Contour dialog box, you will be prompted to select them, Inclusion(s) first, Exclusion(s) second.

Shrink-Wrap Perimeter Reduction

If you do not have Exclusion Perimeters or Areas to define, another option is to allow Carlson to automatically define an Inclusion Perimeter around the data selected, on the fly. This is called Shrink Wrapping. Incidentally, this command is also available on its own on the Draw Menu. With Use Inclusion/Exclusion Areas unselected, the Shrink-Wrap Perimeter Reduction option becomes selectable, with None, Low, Medium and High as the options for it, specifying the degree to which the program attempts to close the Perimeter in on, or tighten around, the dataset.

Erase Previous Contour Entities

This option will perform an erase of Contours prior to generating new ones. It can be set to Off, or set to perform this function only on Contours associated with the current .TIN file being created, or set to erase all Contour entities in the drawing.

Ignore Zero Elevations

This option forces the Surface Modeling function to ignore any data that may be selected for processing that has an elevation of 0.

Specify Input or Output Elevation Range

These options allow you to specify and range of elevations that are to be used as valid input data to use as Surface data, or output data to generate the new Surface.

Interpolate Ridges, Valleys, Summits and Pits, and Minimize Flat Triangles

These options are typically only utilized when the input data source is contour data. These options work to build a more accurate Surface in places where the Contours are prone to misrepresent the actual conditions.

Simplify Surface

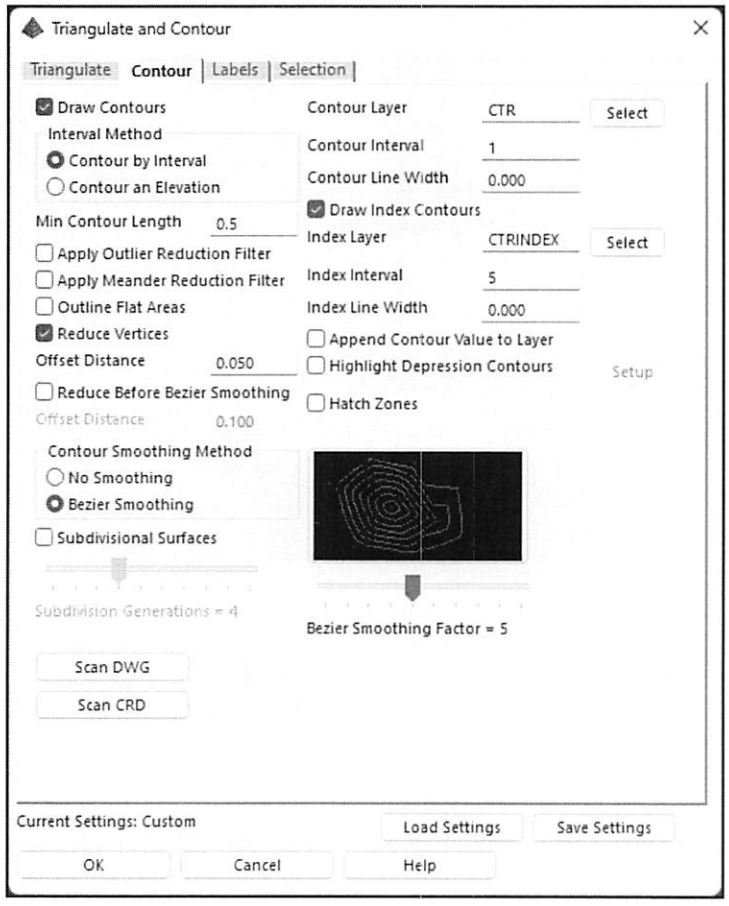
This option instructs the triangulation process to remove as much data as it can while preserving an accurate Surface Model. This is used to get the Surface Model file size down as low as possible.

Maximum Triangle Length

This option allows you to set the maximum length for triangles in the .TIN. This is another way to eliminate inaccurate areas of Surface Modeling.

Contour Tab

The *Contour* tab contains the settings that control the generation of Surface Contours.



Draw Contours

This setting determines if Contours are drawn or not.

The Contour Settings

Contour by Interval is the most commonly used Interval Method. Other Settings determine what layer the Intermediate Contours are to be drawn on, what interval is drawn, the line thickness for the Contours, whether Index Contours are generated, and if so, the layer, interval and thickness properties desired for them.

Contour Smoothing

Different algorithms can be applied to smooth the Contours to give them a more natural or hand drawn appearance. Most typically, Bezier smoothing is used, with a smoothing factor of between 5 and 8. This generates good looking Contours that do not stray far from the actual straight interpolation paths.

Scan DWG

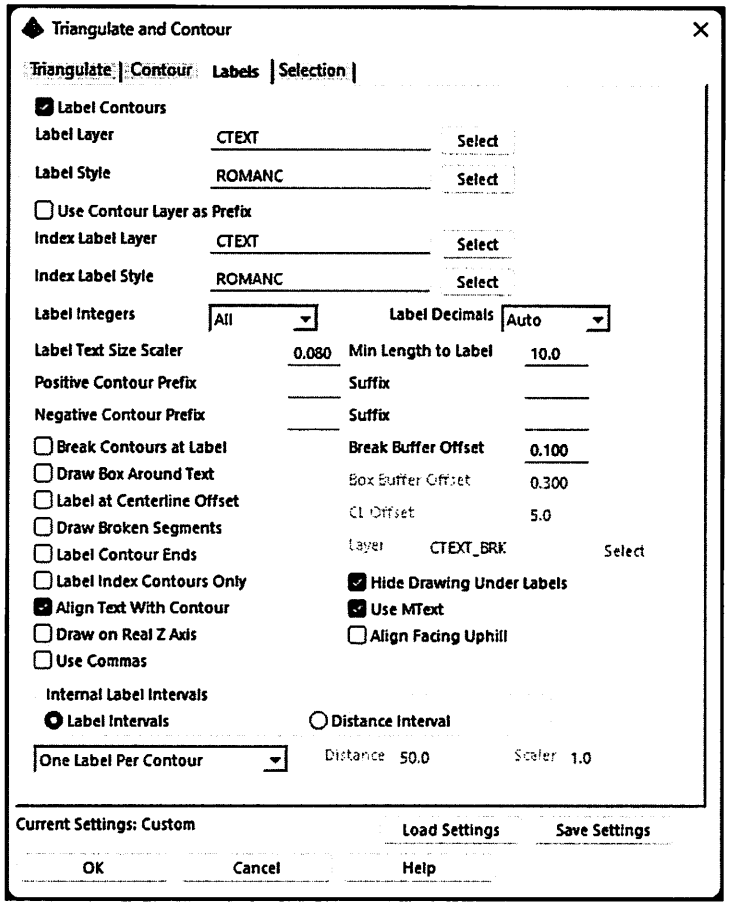
This button displays the minimum and maximum elevations of the entities in the drawing.

Scan CRD

This button displays the minimum and maximum elevations of the points in the CRD file.

Labels Tab

The *Labels* tab contains the settings for labeling contours.



Label Contours

This controls whether or not Labels are generated.

CAD Properties of Labels

These are settings to control the layer for Intermediate and Index Contour Labels, as well as the Text Style to be used.

Label Text Size Scaler

The Text Size Scaler should be set to the value that you want Labels to be drawn on paper when plotted.

The Break Contours at Label, Hide Drawing Under Labels, and Use Mtext Settings

In most cases, you do not want the program to physically break the Contours in the drawing to place a Label, but you also do not want the linework of the Contour to appear to be drawn though the text. For that reason, Break Contours at Label is typically disabled, and Hide Drawing Under Labels is used to hide the Contour.

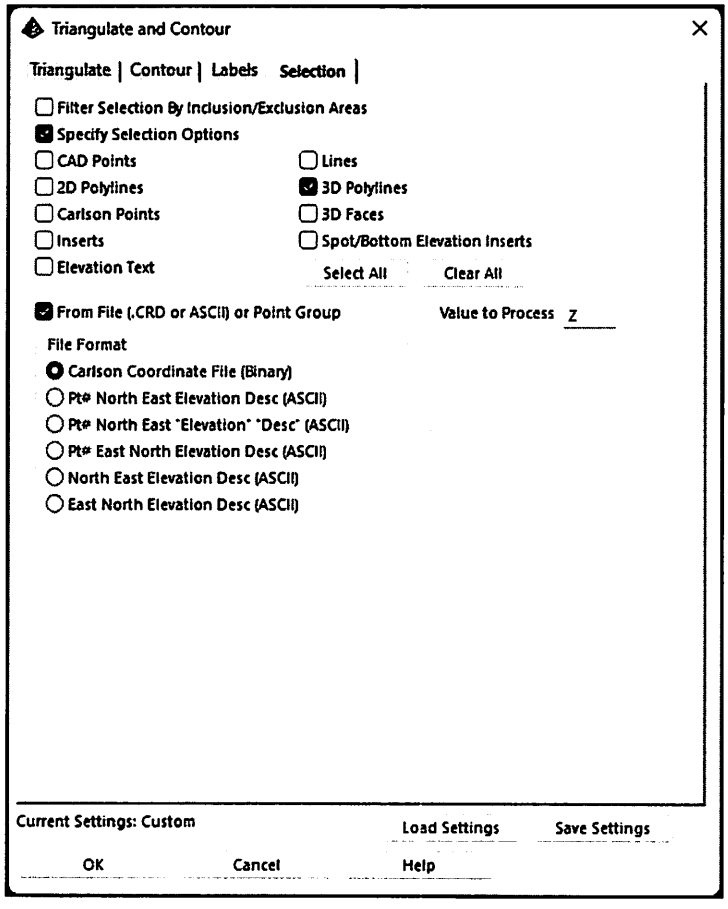
Hide Drawing Under Labels without Mtext creates a CAD Wipeout entity with each Label, and joins the Wipeout with the Text as a Group. This works well, but many end users prefer not to use Wipeouts, mostly because of potential issues with plotting. When combined with Mtext, this option now creates Mtext labels with the background masks already enabled instead of creating a Wipeout.

Internal Label Intervals

Carlson Software can automatically create one, two, three or four Labels per Contour, or they can be automatically created at set distance intervals along the Contours.

Selection Tab

The *Selection* tab contains the settings that control which type of Surface Data is incorporated into the Surface generation.



Filter Selection By Inclusion/Exclusion Areas

When selected, any entities outside a specified Inclusion Perimeter, or Inside a specified Exclusion Perimeter, are ignored in the triangulation process. When disabled, all entities specified as Surface data are used for triangulation, and then those outside the Inclusion or inside the Exclusion Perimeters are removed.

Specify Selection Options

When selected, this allows you to specify which entity types are used in the triangulation process, and which are ignored.

From File

The From File option allows the use of Point data that is not represented in the drawing as Point Blocks. It is also the only way to enable the use of Point Groups as a Surface Modeling data source, which is a very common and useful technique to specify what Point data is to be used and what is not.

Exercise: Using Triangulate and Contour for Surface Modeling

In this exercise you use the Triangulate and Contour feature to generate a new Surface, Contour it, and automatically Label the Contours.

You do the following:

- Review and adjust settings for Triangulate and Contour
- Create a Surface File
- Generate Labeled Contours for the Surface in the Drawing

4.3.1 Using Triangulate and Contour

1. Continue working in the drawing **Surface.dwg**.

If you have not completed the previous lessons:
Open *4_3.dwg* from the project folder *APG 2023 Lesson 4_3.*

This drawing contains Points and 3D Polylines to use for surface modeling.

2. Select **Ribbon: Surface ⇒ Triangulate and Contour ⇒ Triangulate & Contour.**

Alternatively, from the pull-down menu:
Select **Surface ⇒ Triangulate & Contour.**

The *Triangulate and Contour* dialog box opens.

3. Select the **Triangulate** tab.

4. Confirm the option to **Draw Surface Object** is disabled.

5. Confirm the option to **Draw Triangulation Lines** is disabled.

6. Confirm the option to **Draw Triangulation Faces** is disabled.

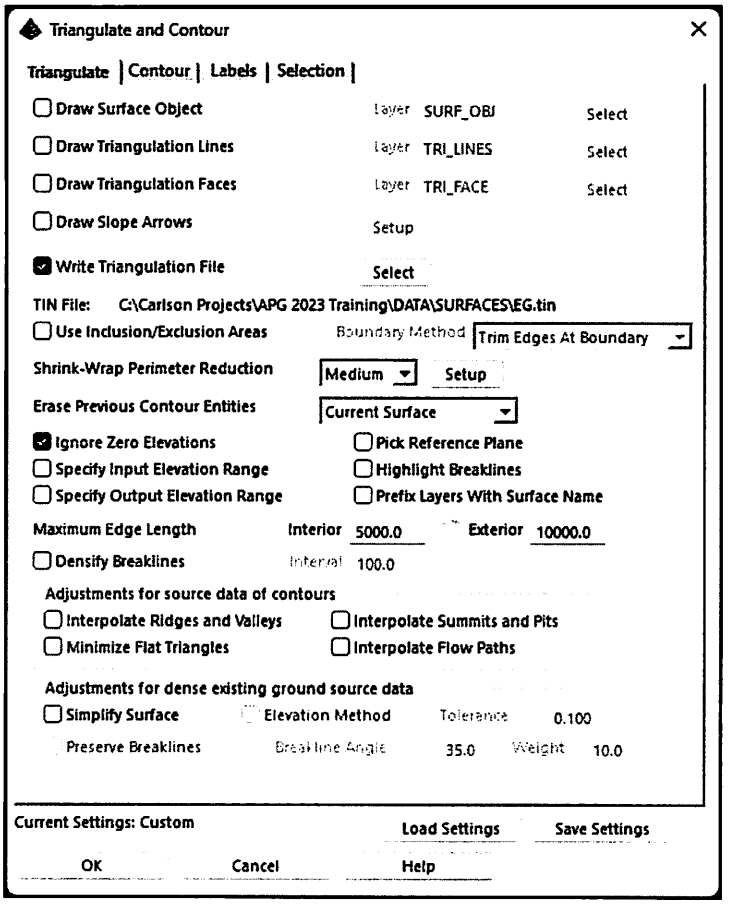
7. Confirm the option to **Draw Slope Arrows** is disabled.

There is no need to draw the surface object, triangulation lines, faces, or slope arrows when you build the surface.

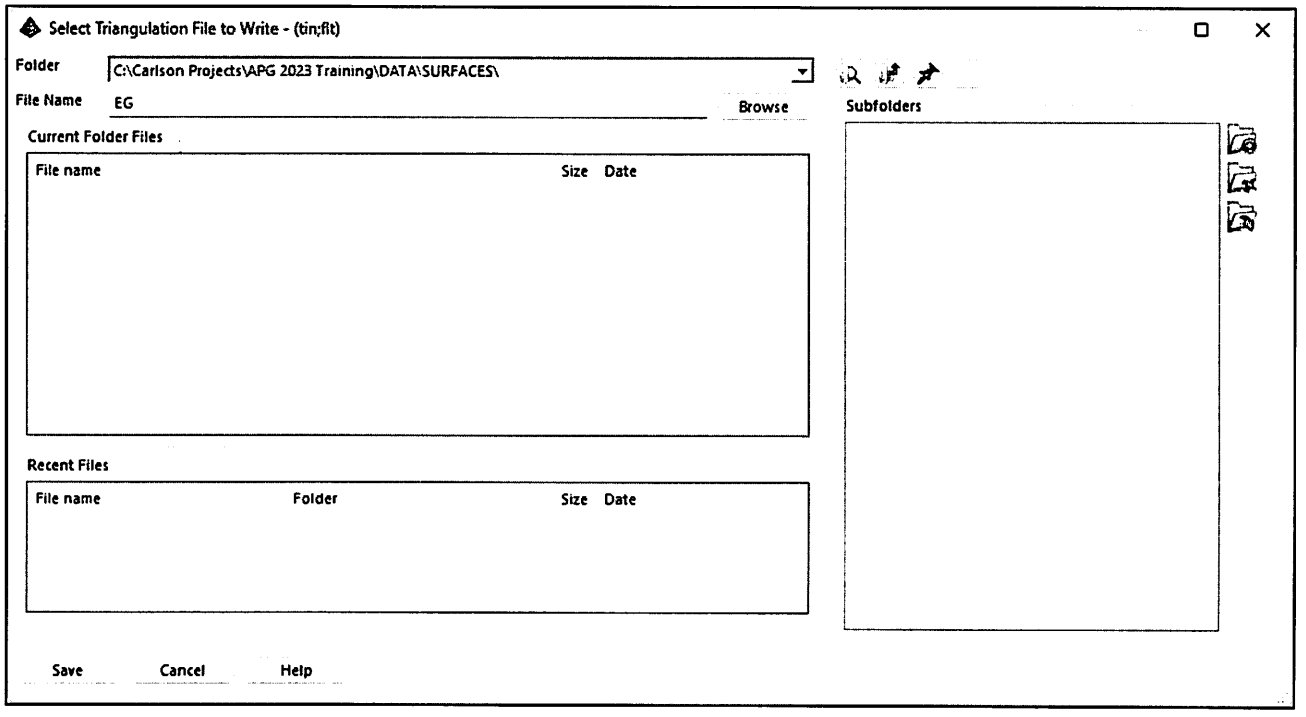
8. Enable **Write Triangulation File**.

It is generally beneficial to write an external .TIN file to store the surface definition, as it can then subsequently be utilized by many other functions within the program.

9. Click **<<Select>>** to designate the name and location for this .TIN file.



The *Select Triangulation File to Write* dialog box opens.



10. Create a new file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\EG.tin**

If you have skipped previous lessons and did not create the project above, create a new file:
C:\Carlson Projects\APG 2023 Lesson 4_3\Data\Surfaces\EG.tin

11. Click **<<Save>>**.

12. Back in the *Triangulate and Contour* dialog box, confirm the **Use Inclusion Exclusion Perimeter** option is disabled.

To use the Shrink-Wrap option, *Use Inclusion Exclusion Perimeter* must be disabled

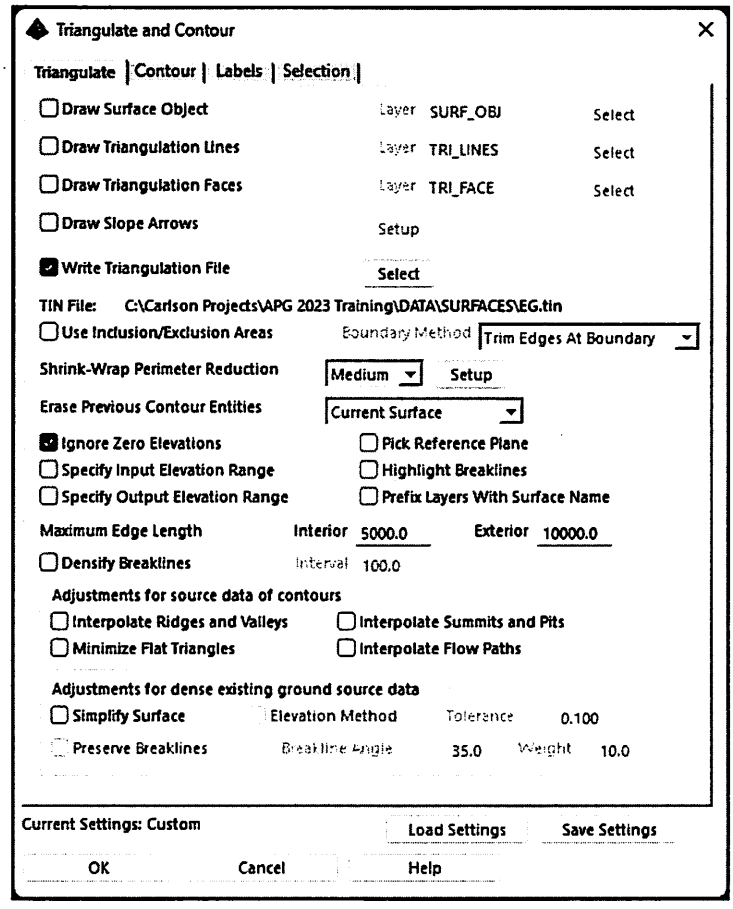
13. Set the **Shrink-Wrap Perimeter Reduction** to **Medium.**

Shrink-Wrap Perimeter Reduction analyzes the data provided and defines a tight boundary around the extents of the data, thereby eliminating triangulation outside the boundary where there is no surface data.

14. Set **Erase Previous Contour Entities** to **Current Surface.**

15. Confirm the **Ignore Zero Elevations** option is enabled.

16. Review the other settings on the *Triangulate* tab and confirm they are set to match the graphic.



17. Select the **Contour** tab.

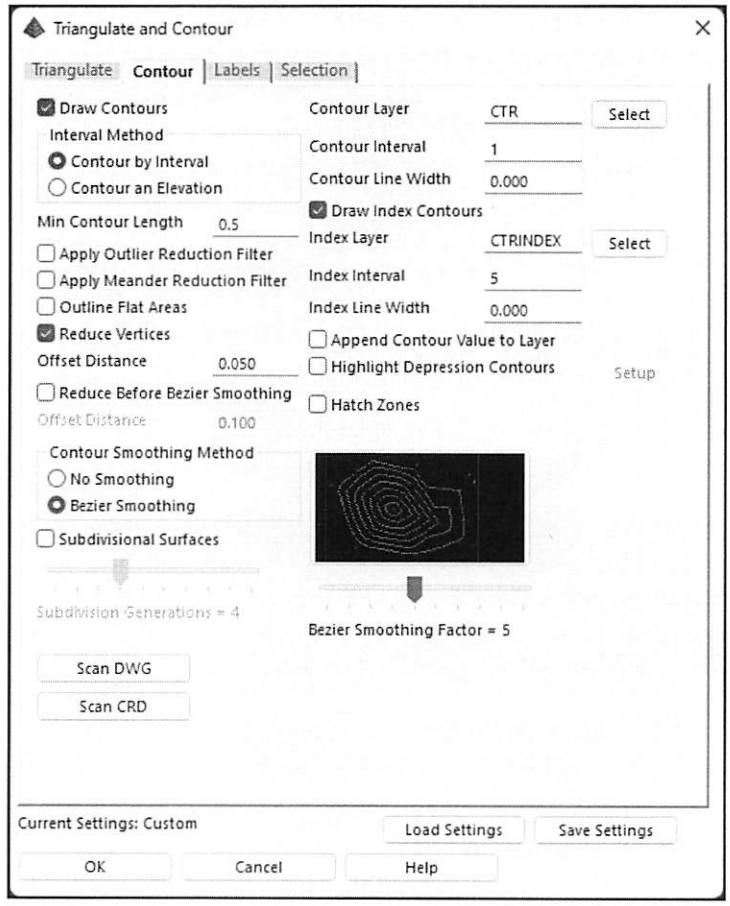
18. Enable the **Draw Contours** option.

19. Enable **Draw Index** Contours.

The layer names for the contours can be set to your standards, for this exercise you will leave them as the defaults.

20. Set the **Contour Interval** to **1**.

21. Set the **Index Interval** to **5**.



22. Select the **Labels** tab.

23. Enable the **Label Contours** option.

24. For the **Label Text Size Scaler** enter **.08**.

25. Disable the **Break Contours at Label** option.

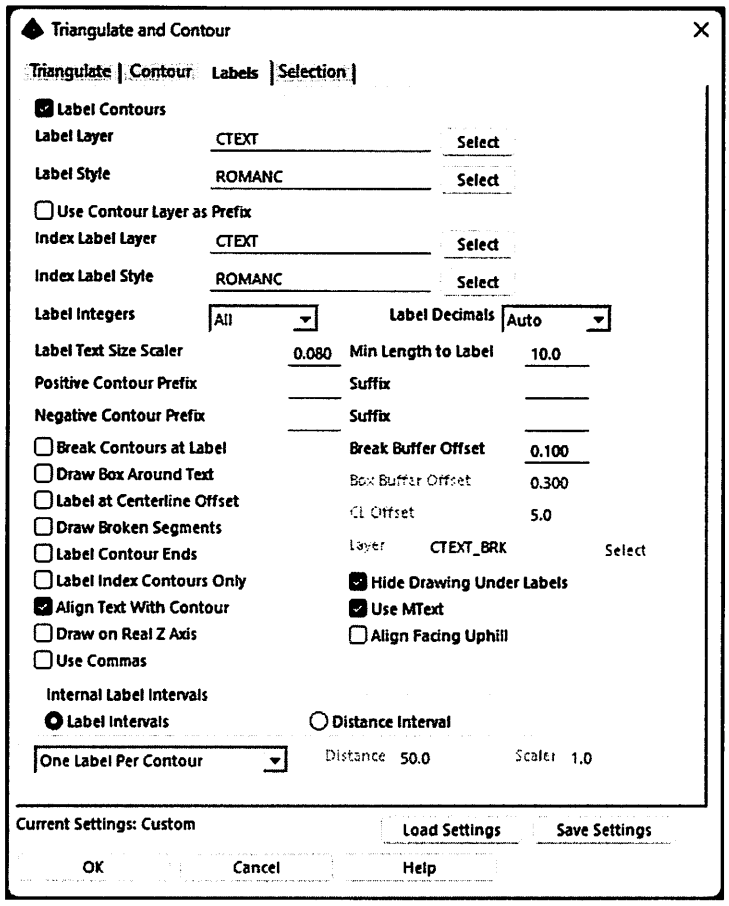
This will leave the polylines being used as contours unaffected and complete.

26. Confirm the **Align Text With Contour** option is enabled.

27. Enable the **Hide Drawing Under Labels** option.

When selected, in combination with the Use Mtext option, Mtext labels are created with their background masks already enabled.

28. Enable the **Use MText** option.



29. Confirm the **Internal Label Intervals** option is set to **Label Intervals**.

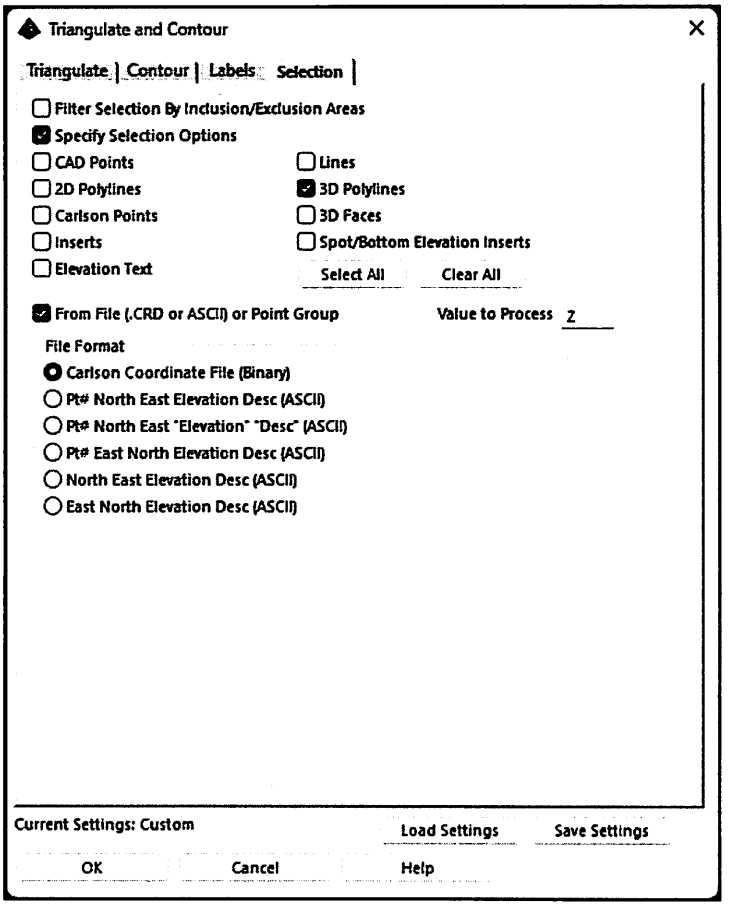
30. Confirm the interval is set to **One Label Per Contour**.

31. Select the **Selection** tab.

32. Enable **Specify Selection Options**.

33. Click **<<Clear All>>**.

34. Enable the **3D Polylines** option.



In this exercise, we only have 3D Polylines to go along with the points as *Surface* data. Using only the 3D Polyline option will filter out any other object types that you might accidentally select.

35. Enable the **From File or Point Group** option.

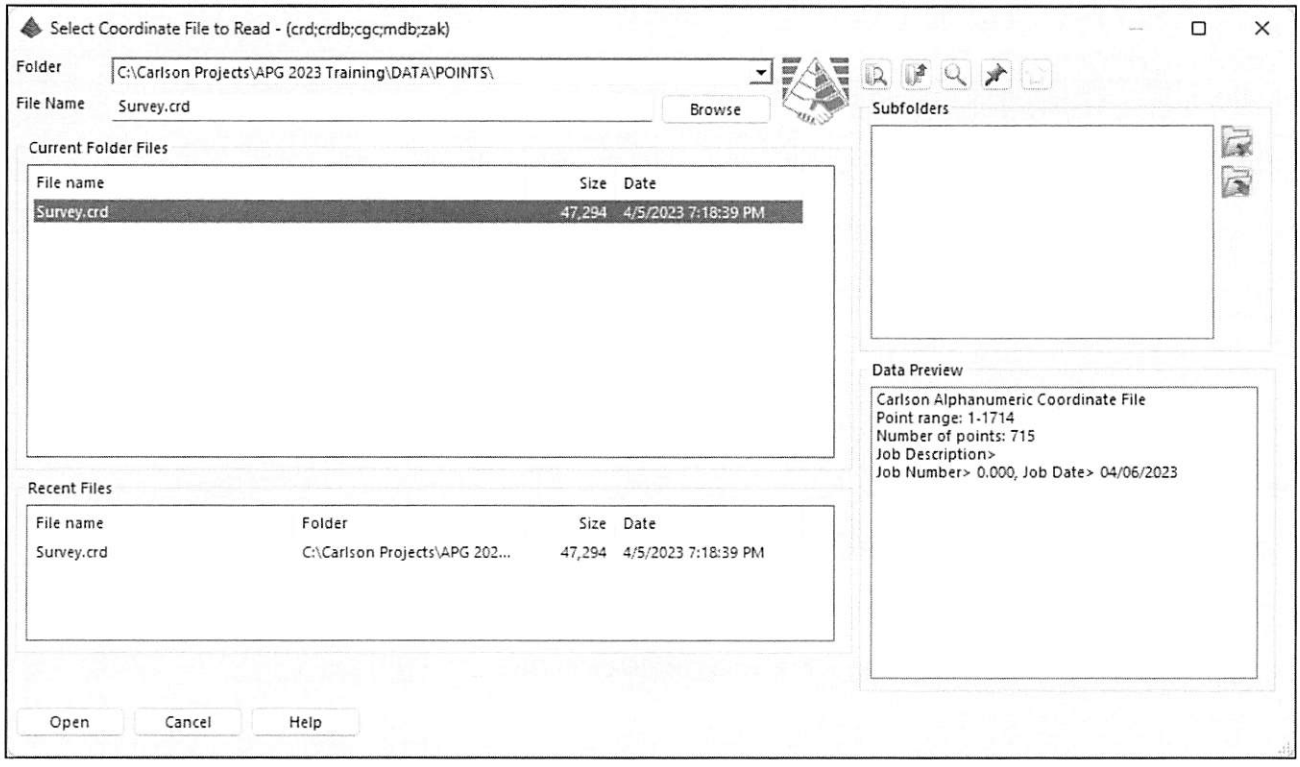
In this exercise, you select the option to use point data from the CRD File currently associated with the drawing. This is just one approach. However, in other situations, you may be using point blocks in the drawing as the data source instead.

36. Click **<<OK>>**.

37. Select the Breaklines in the drawing with a crossing window and press **Enter**.

The points and any other objects will be filtered out.

The *Select Coordinate File to Read* dialog box opens.



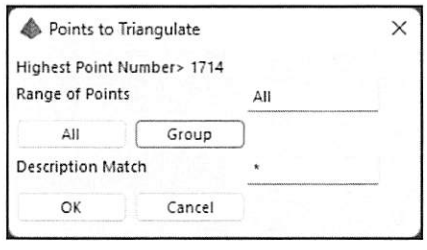
38. Select the file: **C:\Carlson Projects\APG 2023 Training\Data\Points\Survey.crd**

If this file is in your list of *Recently used files*, select it from there, it will be faster than browsing for it.

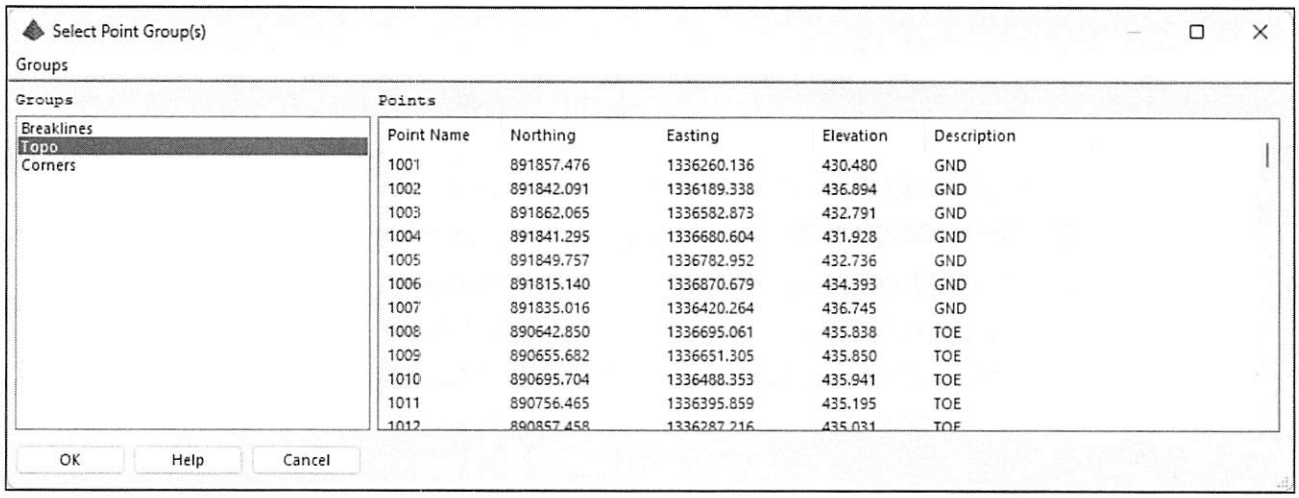
If you have skipped previous lessons and did not create the .CRD file you can browse for a copy: **C:\Carlson Projects\APG 2023 Lesson 4_3\Data\Points\Survey.crd**

39. Click **<<Open>>**.

40. In the *Points to Triangulate* dialog box click **<<Group>>**.



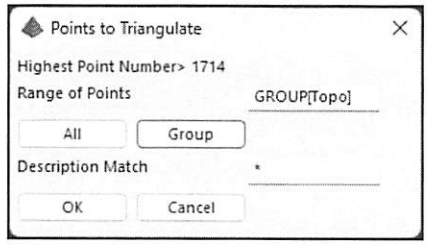
This opens the *Select Point Group(s)* dialog box. Here you can select one or more point groups to use in the triangulation.



41. Select the point group **Topo**.

42. Click **<<OK>>**.

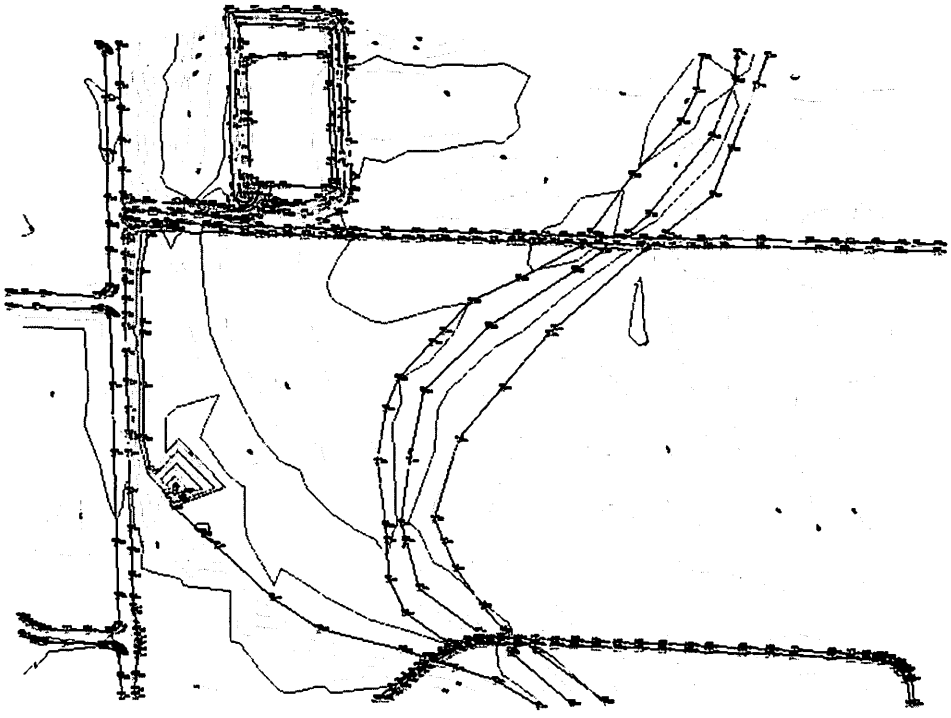
43. Back in the *Points to Triangulate* dialog box click **<<OK>>**.



The Breakline points are already in the drawing, but are also a subset of the Topo Point Group, so they are being selected twice, but the software resolves that automatically.

The points and 3D Polylines are used to define a digital terrain model, an external surface file is generated, contours are generated to represent the surface in the drawing, at the interval and on the layers specified, and those contours are labeled with Mtext, one label per contour.

The new contours will look like the graphic below.



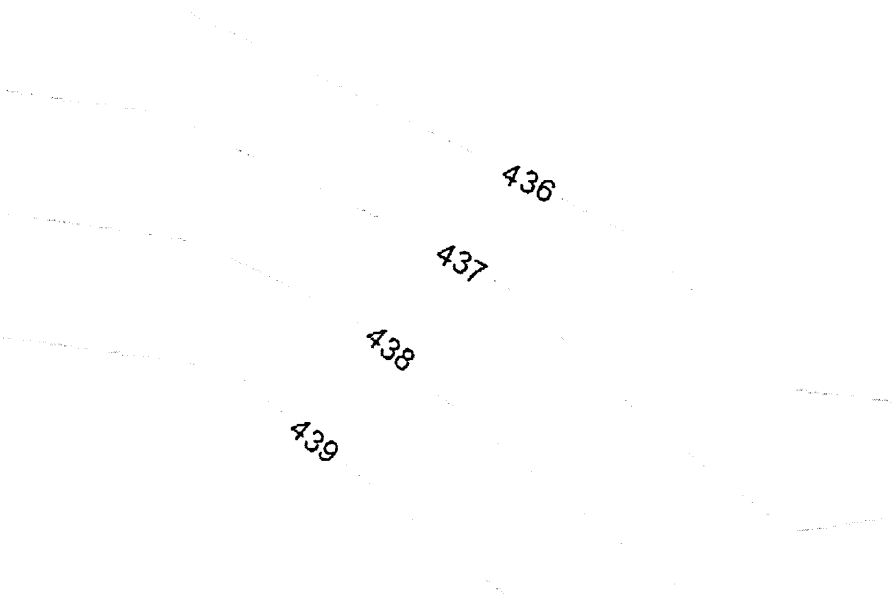
Lesson Review

In this lesson, you used the Triangulate and Contour command to generate a Surface. You navigated through the Triangulate, Contour, Labels, and Selection tabs in the Triangulate and Contour dialog box.

4.4 Lesson: Working with Contour Labels

Introduction

Contour labels can be added to the drawing after the surface has been created and contours have been drawn. Labels can also be moved along existing contours.



Key Concepts

Concepts and key terms covered in this lesson are:

- Adding Contour Labels
- Repositioning Contour Labels along Contours

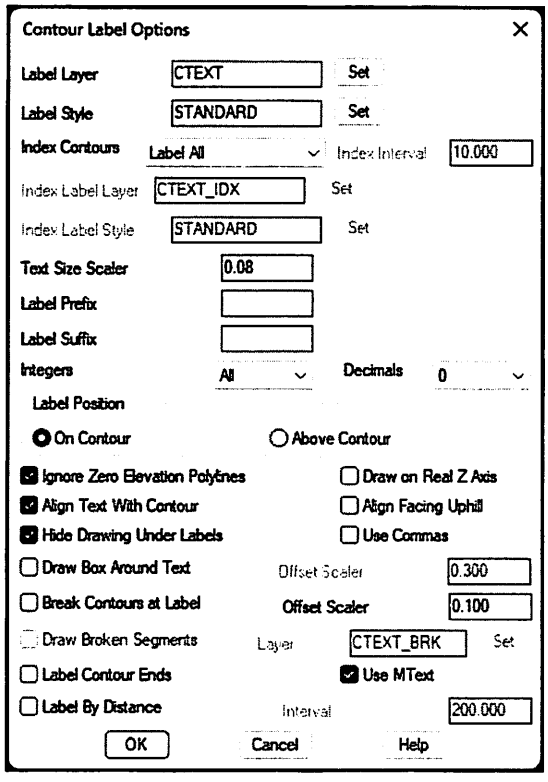
Objectives

After completing this lesson, you will be able to:

- Add Contour Labels to existing Contours
- Reposition Contour Labels along Contours

Contour Label Options

When adding contour labels to contours already existing in the drawing, the *Label Options* are the same as when Labels are generated with the contours through the *Triangulate and Contour* command.



If you would like to review the specifics of the *Label Options*, please refer to the discussion at the beginning of Lesson 4.3, prior to Exercise 4.3.1.

Exercises: Manually Adding Additional Contour Labels and Repositioning Them

In these exercises you create additional Contour Labels for existing Contours, and then reposition some Labels along the Contours.

You do the following:

- Label Contours
- Move Labels along Contour

4.4.1 Adding Contour Labels

1. Continue working in the drawing **Surface.dwg**.

If you have not completed the previous lessons:
Open *4_4.dwg* from the project folder *APG 2023 Lesson 4_4*.

2. Select **Ribbon: Surface ⇒ Triangulate and Contour ⇒ Contour Elevation Label.**

Alternatively, from the pull-down menu:
Select **Surface ⇒ Contour Utilities ⇒ Contour Elevation Label.**

The *Contour Label Options* dialog box opens.

3. Confirm the **Index Contours** option is set to **Label All**.

4. For the **Label Text Size Scaler** enter **.08**.

5. Confirm the **Align Text With Contour** option is enabled.

6. Enable the **Hide Drawing Under Labels** option.

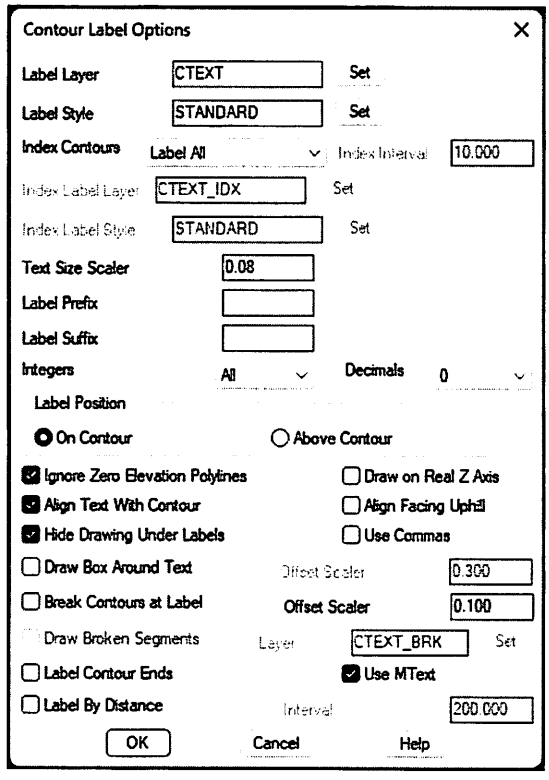
When selected, in combination with the Use Mtext option, Mtext labels are created with their background masks already enabled.

7. Disable the **Break Contours at Label** option.

This will leave the polylines being used as contours unaffected and complete.

8. Enable the **Use MText** option.

9. Click **<<OK>>**.



10. In the drawing, when prompted, pick 2 points to draw a line across the contours in the desired locations for new contour labels.

11. **Enter** to end the command.

4.4.2 Moving Contour labels

1. Continue working in the drawing from the previous exercise.

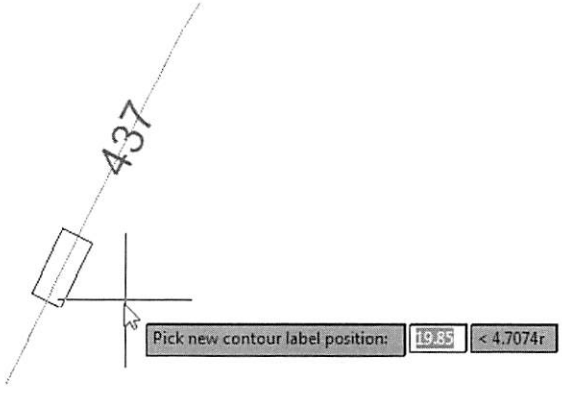
2. Select **Ribbon: Surface ⇒ Triangulate and Contour ⇒ Move Label Along Contour.**

Alternatively, from the pull-down menu:
Select **Surface ⇒ Contour Utilities ⇒ ⇒ Move Label Along Contour.**

3. In the drawing, pick a contour label to move.

4. Use the mouse to drag the label along the contour line to relocate it. (Do not hold the mouse button down, simply move the mouse to move the label.)

5. **Enter** to end the command.



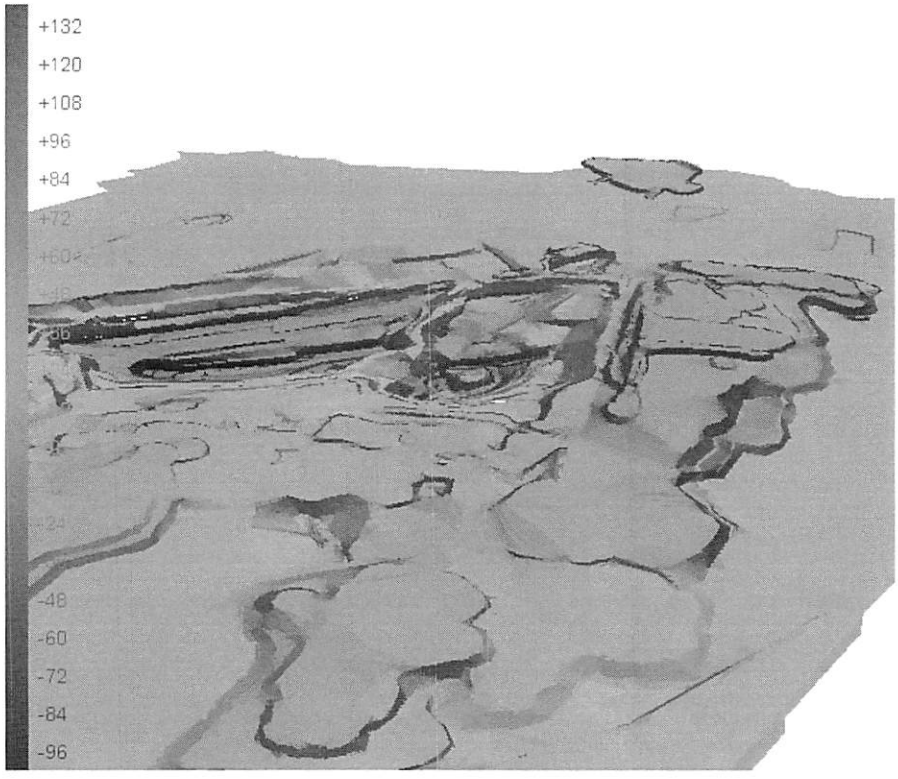
Lesson Review

In this lesson, you added *Contour Labels* to existing *Contours* and then repositioned *Contour Labels* along *Contours*.

4.5 Lesson: Viewing Surfaces

Introduction

Once an external TIN file has been created using the *Triangulate and Contour* command, *Carlson Software* has two excellent utilities called the *Surface FIle Viewer* and the *Drawing Viewer*, either or both of which you can use to view that surface.



Key Concepts

Concepts and key terms covered in this lesson are:

- Using the Surface File Viewer
- Using the Drawing Viewer
- Options within the Carlson Software 3D Viewer

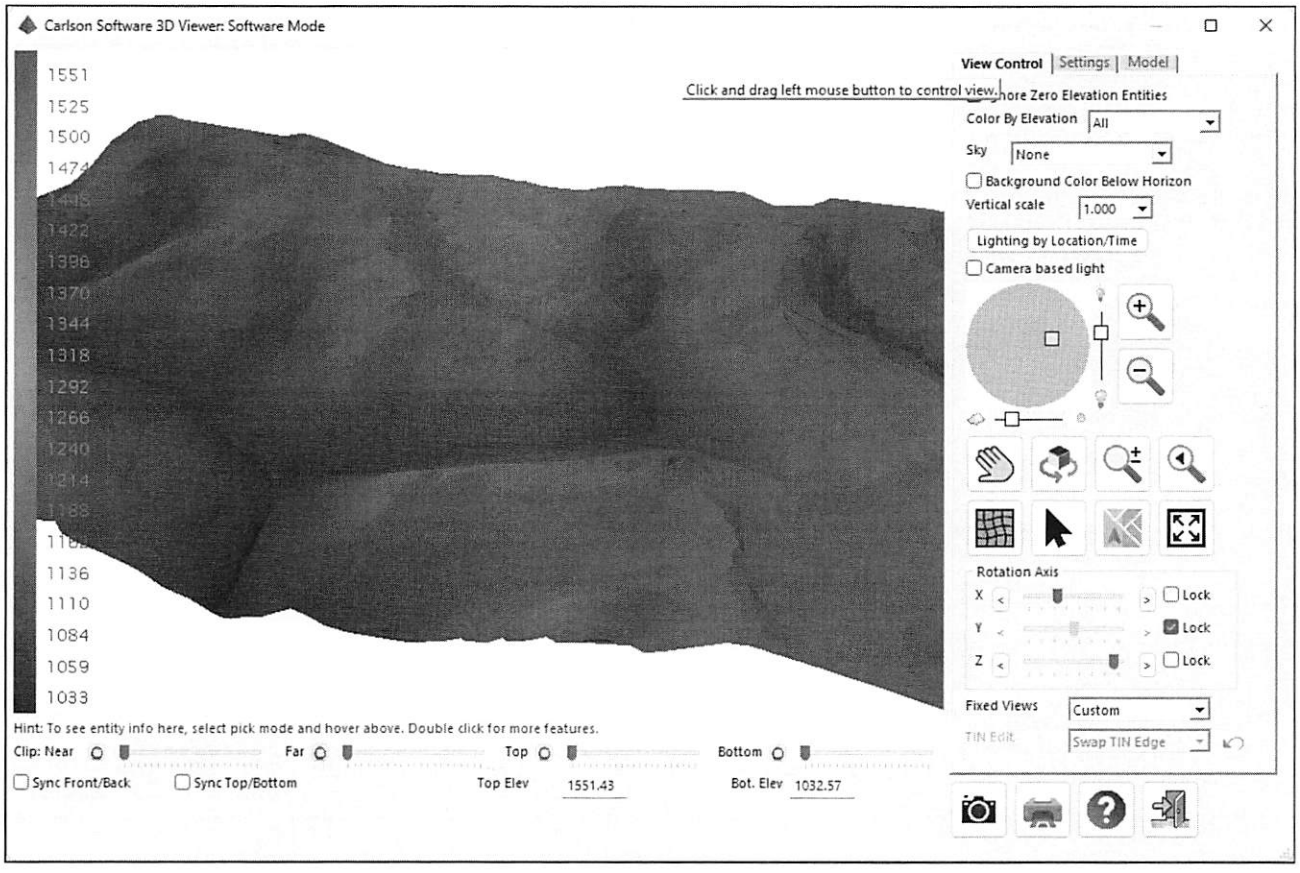
Objectives

After completing this lesson, you will be able to:

- Effectively Utilize the Surface File Viewer
- Effectively Utilize the Drawing Viewer

The Surface File Viewer

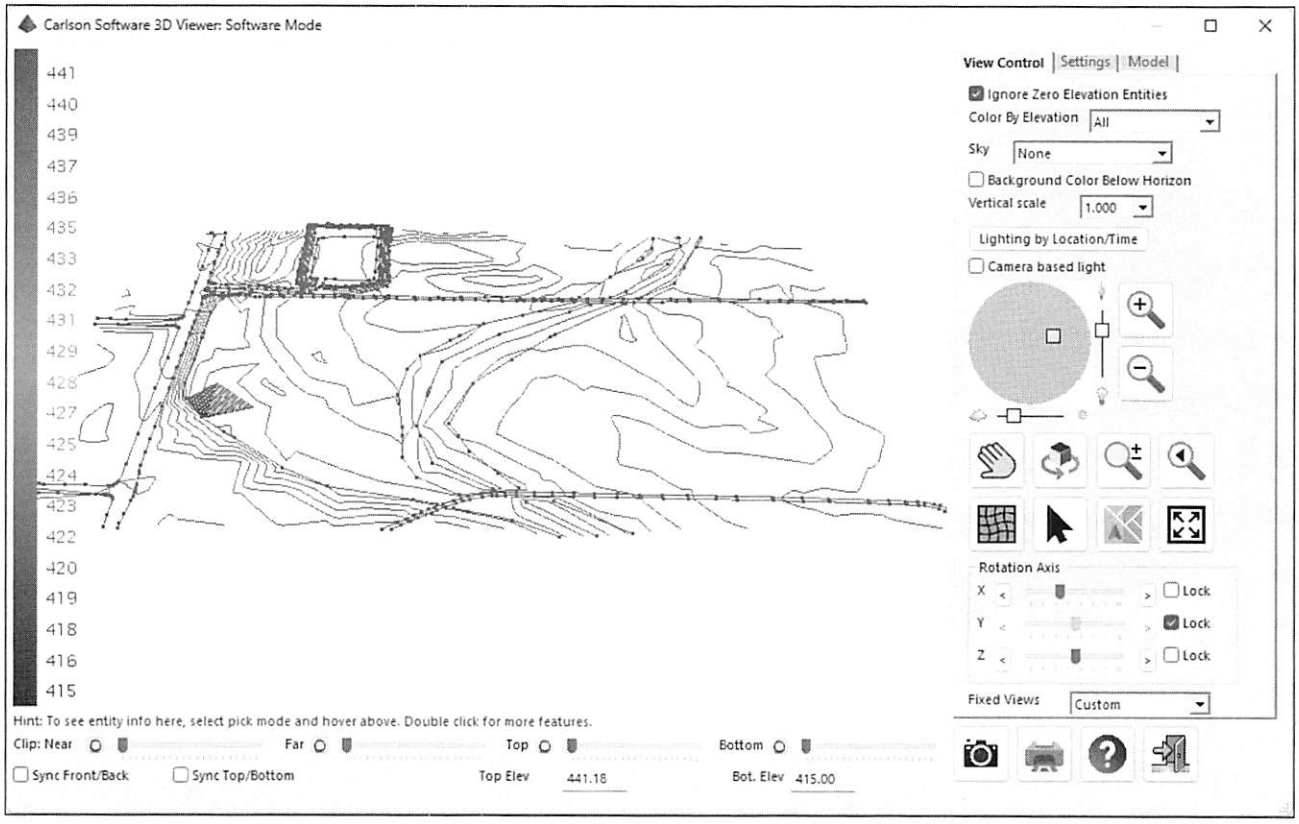
The Surface File Viewer is not using entities in the drawing file to generate the view of the surface but rather is loading the data directly from the external TIN file into the viewer.



In the *Carlson Software 3D Viewer*, the model can be shaded, rotated in three-dimensional space, the light source adjusted, and colors assigned to ranges of elevations, among other utilities. This gives the user a real sense of the makeup of the surface and can help identify errors or places that need additional data like break lines to be more accurate.

The Drawing Viewer

The Drawing Viewer uses selected entities in the drawing file to generate the view of those objects that you can rotate and view in 3D.



The *Drawing Viewer* command uses the same *Carlson Software 3D Viewer* as the *Surface File Viewer* command. The difference is this command views selected objects from the drawing rather than a TIN file.

In the *Carlson Software 3D Viewer*, the objects can be shaded (providing they are 3D faces or other objects you can shade), rotated in three-dimensional space, the light source adjusted, and colors assigned to ranges of elevations, among other utilities. This gives the user a real sense of the makeup of the surface and can help identify errors or places that need additional data like break lines to be more accurate.

Exercises: Using the Surface File Viewer and the Drawing Viewer

In these exercises you utilize the *Surface File Viewer* and the *Drawing Viewer* to visualize existing .TIN files and Drawing Objects.

You do the following:

- View a .TIN Surface File in the *Surface File Viewer*
- View selected drawing objects with the Drawing Viewer

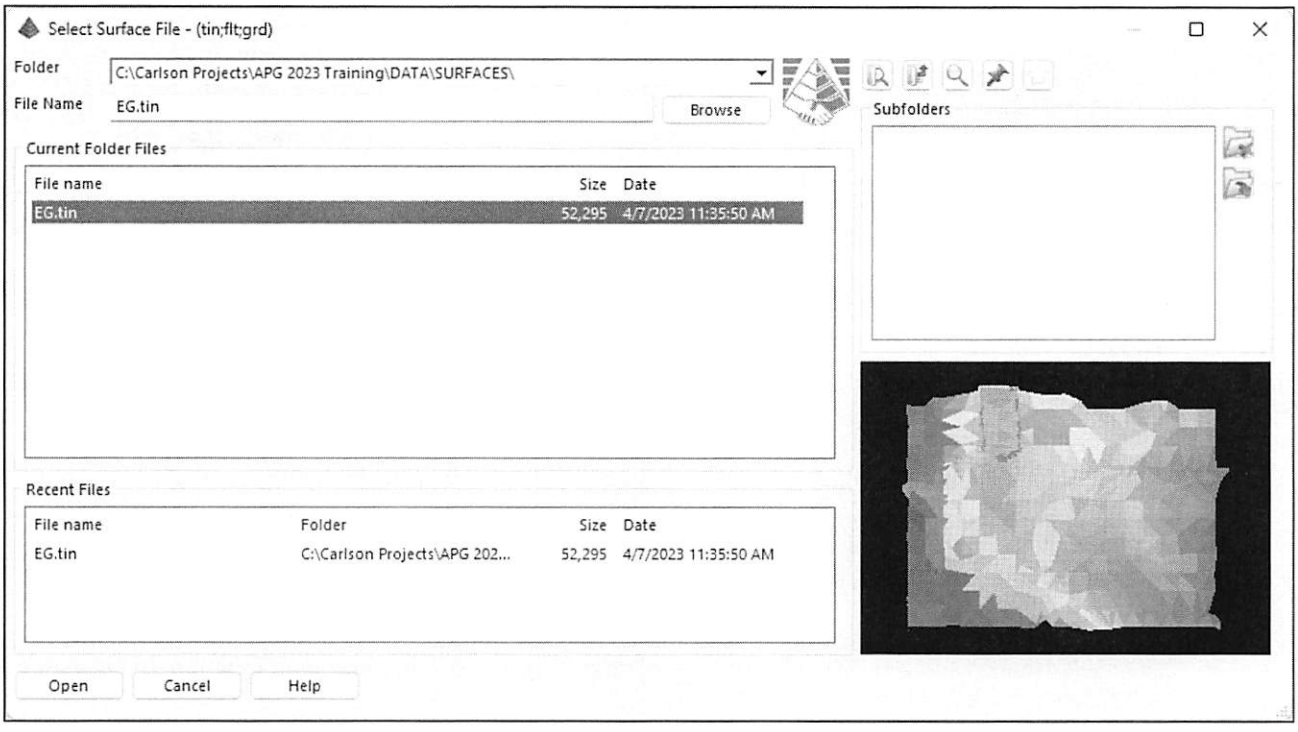
4.5.1 Using the Surface File Viewer

1. Continue working in the drawing **Surface.dwg**.

If you have not completed the previous lessons:
Open *4_5.dwg* from the project folder *APG 2023 Lesson 4_5*.

2. From the pull-down menu: Select **View ⇒ 3D View ⇒ Surface File Viewer.**

The *Select Surface File* dialog box opens.



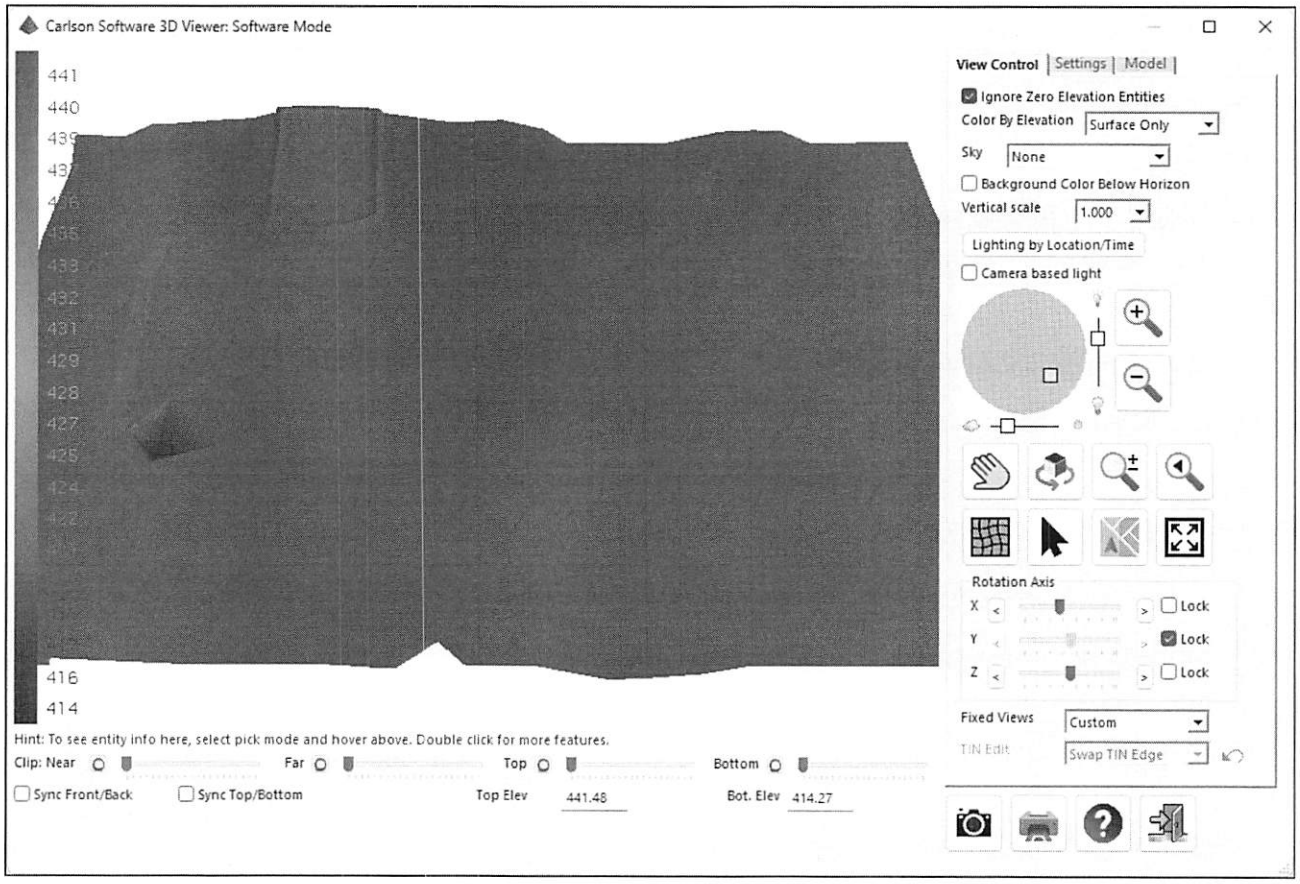
3. Select the file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\EG.tin**

If this file is in your list of *Recently used files*, select it from there, it will be faster than browsing for it.

If you have skipped previous lessons and did not create the .TIN file you can browse for a copy:
C:\Carlson Projects\APG 2023 Lesson 4_5\Data\Surfaces\EG.tin

4. Click **<<Open>>**.

The *Carlson Software 3D Viewer* opens with a plan view of the surface.



5. On the *View Control* tab, set the **Color By Elevation** option to **Surface Only**.

6. If the surface is displayed as a triangular mesh, use the **Toggle shading of surfaces** button to turn shading on.

7. Use your left mouse button to drag the yellow square within the blue circle to adjust the lighting on the surface.

8. Toggle on rotation mode .

9. With your cursor placed over the surface, the cursor will appear as an X and Y axis icon. Hold your left mouse button down and drag the mouse to you and away from you to adjust the viewing angle from the XY plane.

10. With your cursor placed outside the surface, the cursor will appear as a Z icon. Hold your left mouse button down and drag the mouse left and right to adjust the viewing angle in the XY plane.

11. Close the *Carlson Software 3D Viewer.*

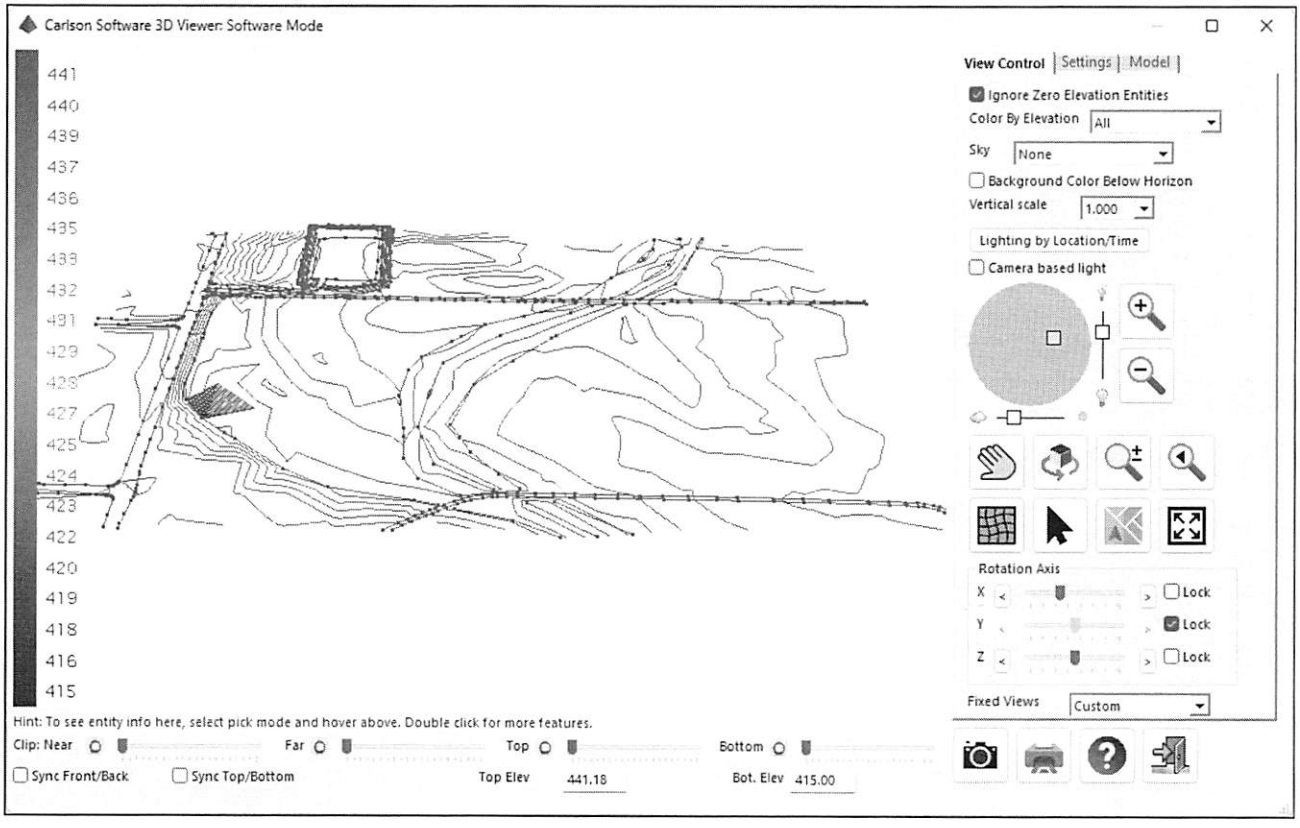
4.5.2 Using the Drawing Viewer

1. Continue working in the drawing **Surface.dwg**.

2. From the pull-down menu: Select **View ⇒ 3D View ⇒ Drawing Viewer.**

3. Select all the objects in the drawing with a crossing window and press **Enter**.

The *Carlson Software 3D Viewer* opens with a plan view of the selected objects.



4. On the *View Control* tab, toggle on rotation mode .

5. With your cursor placed over the surface, the cursor will appear as an X and Y axis icon. Hold your left mouse button down and drag the mouse to you and away from you to adjust the viewing angle from the XY plane.

6. With your cursor placed outside the surface, the cursor will appear as a Z icon. Hold your left mouse button down and drag the mouse left and right to adjust the viewing angle in the XY plane.

7. Enable the **Ignore Zero Elevation** option.

This will remove any objects at elevation zero from the viewer display.

8. Set the **Color By Elevation** option to **All.**

This will color the objects according to their elevation. In this example you will see a large depression in the contours that is colored green and blue. This is most likely an error in the surface and will need to be examined more closely in the next lesson.

9. Close the *Carlson Software 3D Viewer.*

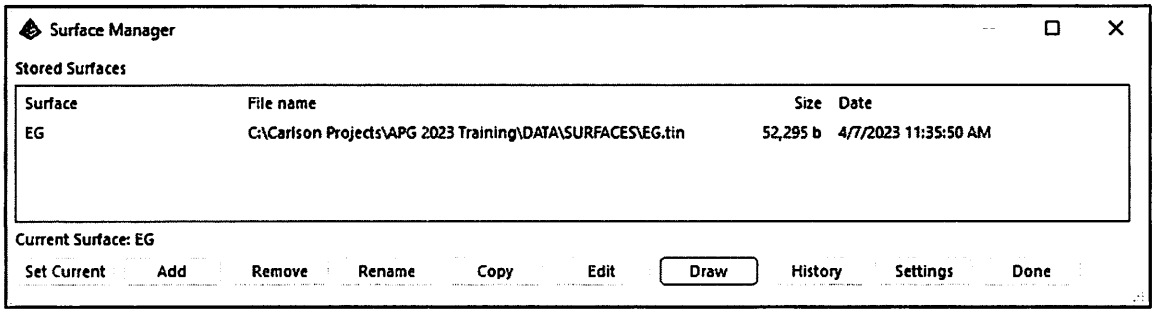
Lesson Review

In this lesson you learned how to use *Surface File Viewer* and the new *Drawing Viewer.*

4.6 Lesson: Editing Surfaces

Introduction

Carlson Software provides a set of tools within the Triangulation Surface Manager to make manual edits to surface models. These edits include adding lines or points, deleting lines or points, editing points, and flipping faces.



Key Concepts

Concepts and key terms covered in this lesson are:

- Using the Triangulation Surface Manager
- Surface Editing Options

Objectives

After completing this lesson, you will be able to:

- Edit Surfaces with the Triangulation Surface Manager

Surface Editing

Once surfaces are generated through the process described in this chapter, if errors are found, or it is determined that a more accurate representation is possible, there are two different approaches to editing and updating the surface.

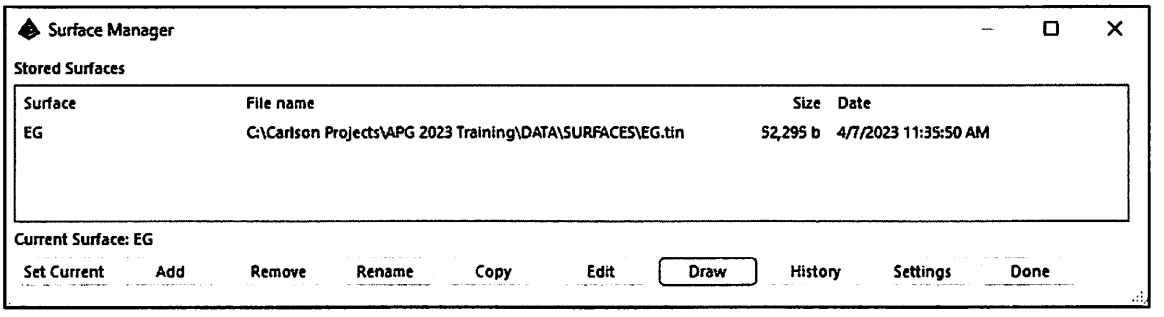
- Updating the Source Data
- Editing the Surface Directly

Updating the Source Data

Correcting the source data can involve adding, deleting or editing the points to model the surface, and/or adding, deleting or editing the breaklines used to model the surface, and THEN reprocessing the data to generate a new TIN.

Editing the Surface Directly

Manipulating the surface after the fact is known as surface editing and is accomplished in *Carlson Software* through the use of the *Surface Manager*.

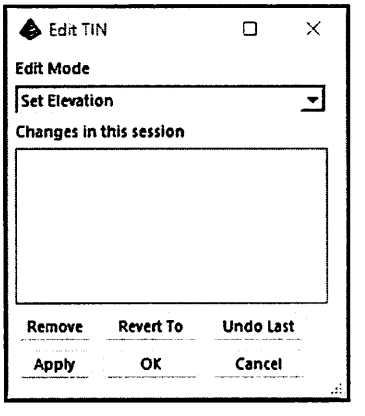


Surface Manager

The Surface Manager dialog box interface provides access to a variety of surface tools. First, surface files are added to the list of stored surfaces, and assigned names as they are added. Listed surfaces can be renamed, removed from the list, or set current. The current surface can be copied to create a new identical surface. The current surface can also be edited with a variety of editing tools. Finally, the properties of the current surface can be altered here, and the results displayed immediately upon exiting the Properties dialog.

Edit

The Editing tools accessed from the Surface Manager are operated from a dialog box or from the command line. The options are to Add Points (AP), Remove Points (RP), Move Points (MP), Set elevations (SP), Add Breaklines (AB), Add Entities (AE), Swap edge (SW), Remove Triangles (RT), Remove Triangles by Fence selection (RF), and Show/Hide Triangles (ST). These operations are performed in real time and the surface is updated with each edit.

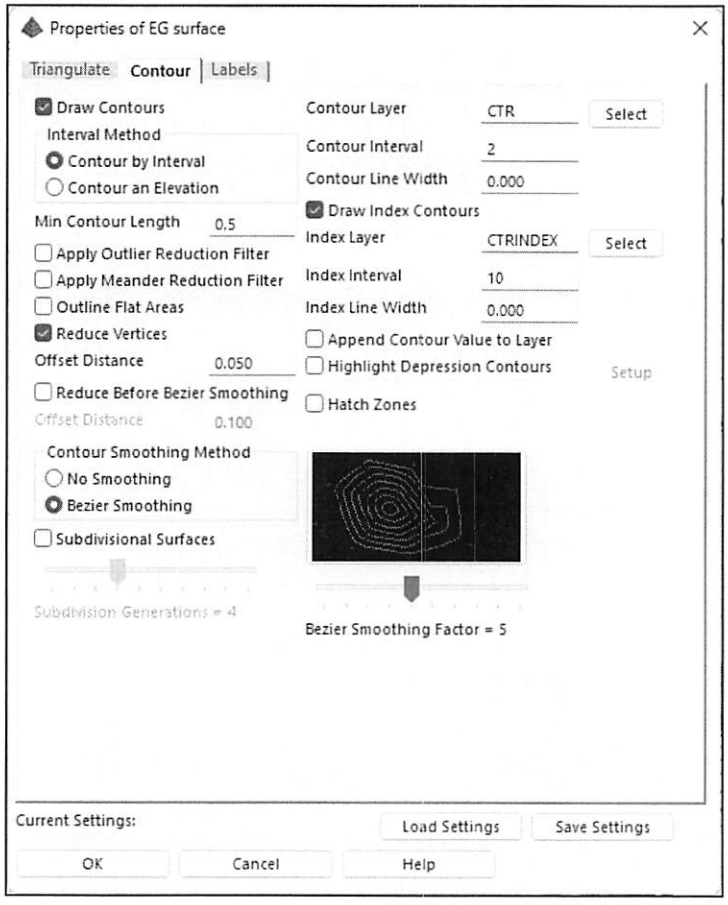


History

There is an option to track changes made to a TIN file through the use of a History file. To utilize the History file, *Track TIN History* must first be enabled in the *Surface Settings* dialog box in *Carlson Configure*.

Draw

The Draw button accesses a dialog box that is very similar to the *Triangulate and Contour* dialog box, without the *Selection* tab, so consequently there is no ability to provide new source data. Using the already defined source data, however, the surface can be recalculated with new settings, and all of the properties of the graphical representations of the surface in the drawing can be changed, including the drawing of triangle lines and/or faces, slope arrows, contours and labels.



Exercise: Surface Editing with the Surface Manager

In this exercise you make a variety of edits to a Surface using the *Surface Manager*.

You do the following:

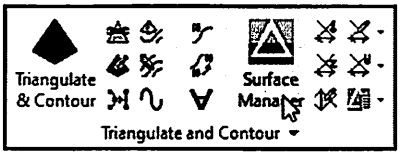
- Access the Surface Manager
- Change a TIN vertex elevation
- Delete TIN Lines
- Swap TIN Faces

4.6.1 Editing a Surface with the Surface Manager

1. Continue working in the drawing **Surface.dwg.**

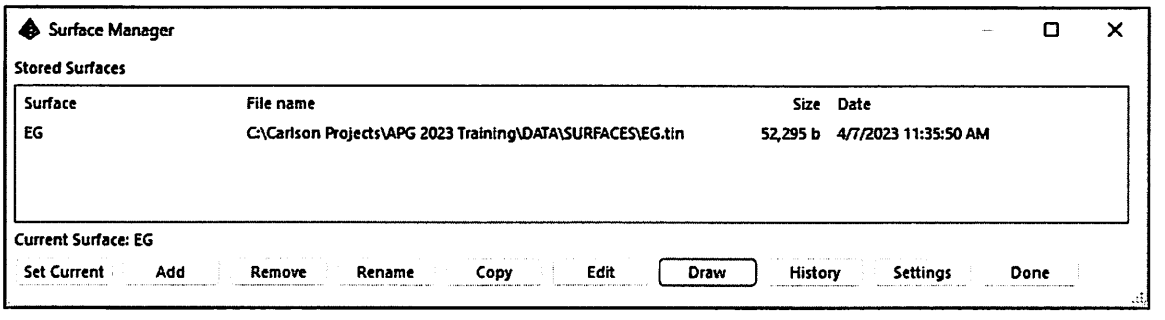
If you have not completed the previous lessons:
Open *4_6.dwg* from the project folder *APG 2023 Lesson 4_6.*

2. Select **Ribbon: Surface ⇒ Triangulate and Contour ⇒ Surface Manager.**



Alternatively, from the pull-down menu:
Select **Surface ⇒ Triangulation Surface Manager ⇒ Surface Manager.**

The *Surface Manager* dialog box opens.



The TIN file for the surface *EG* will be loaded and set *Current.* If it is not in the list click *<<Add>>*. If it is not the *Current Surface* click *<<Set Current>>*.

3. Click **<<Draw>>**.

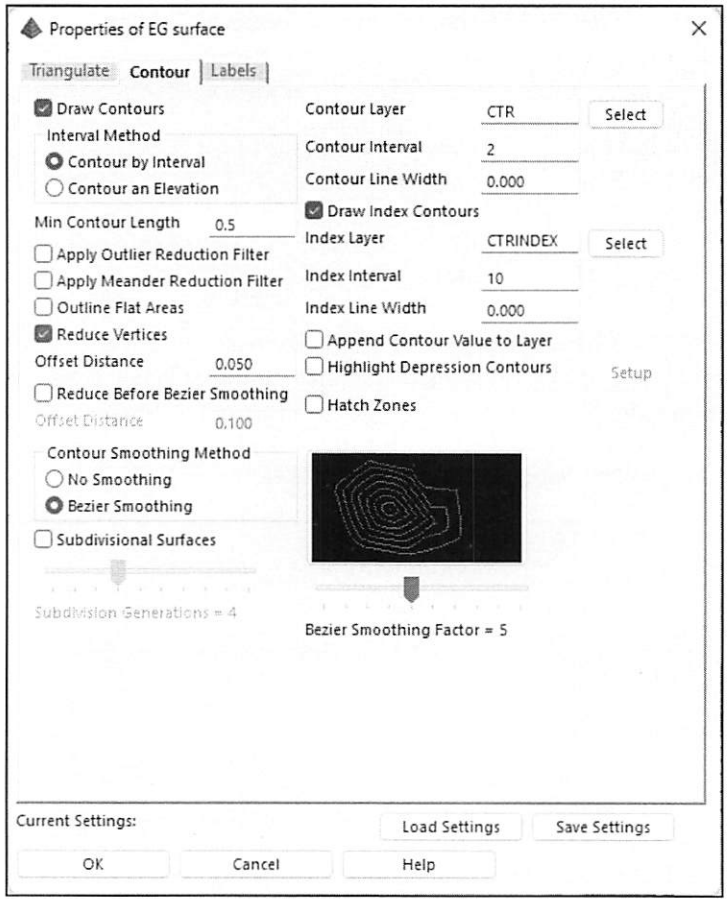
4. In the *Properties of EG Surface* dialog box, select the **Contour** tab.

5. Set the **Contour Interval** to **2**.

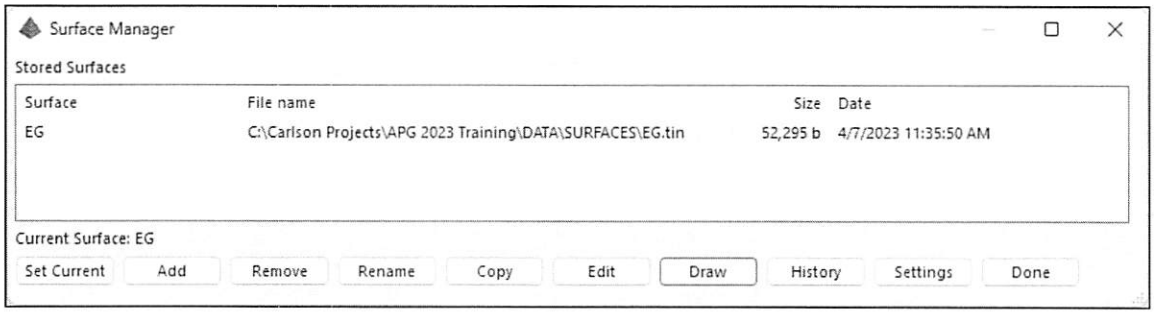
6. Set the **Index Interval** to **10**.

7. Set the **Contour Smoothing Method** to **Bezier Smoothing**.

8. Click **<<OK>>**.



The contours are regenerated in the drawing at the new 2 foot and 10 foot interval with the selected smoothing.



9. Back in the *Surface Manager* dialog box, click **<<Draw>>** again.

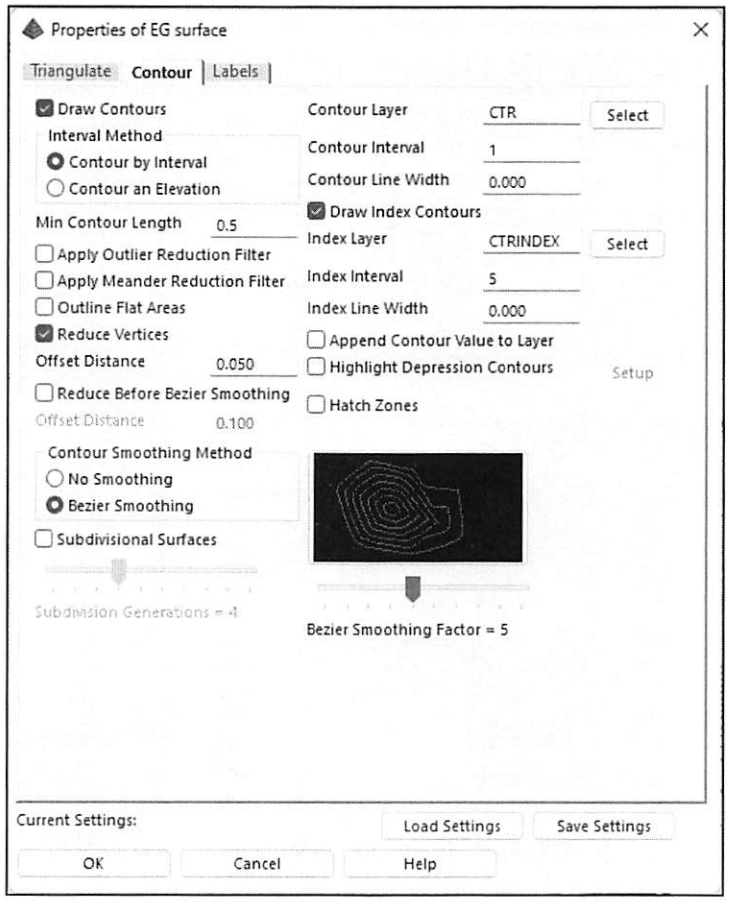
10. In the *Properties of EG Surface* dialog box, select the **Contour** tab.

11. Set the **Contour Interval** to **1**.

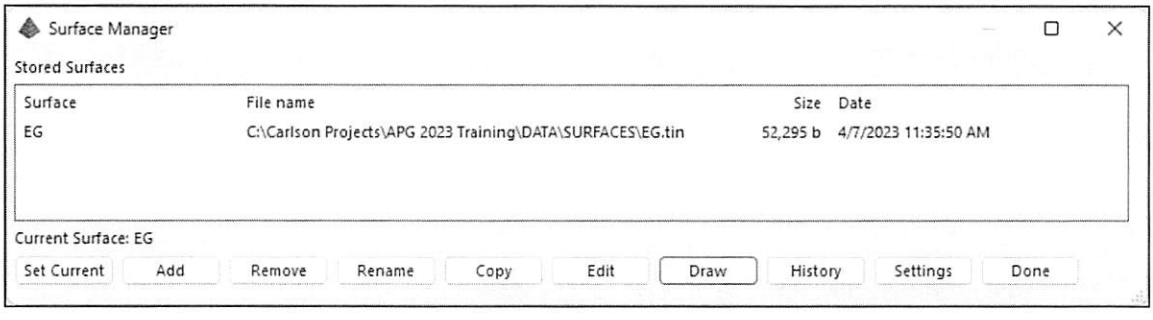
12. Set the **Index Interval** to **5**.

13. Set the **Contour Smoothing Method** to **Bezier Smoothing**.

14. Click **<<OK>>**.



The contours are regenerated in the drawing at a 1 foot and 5 foot interval with the selected smoothing.

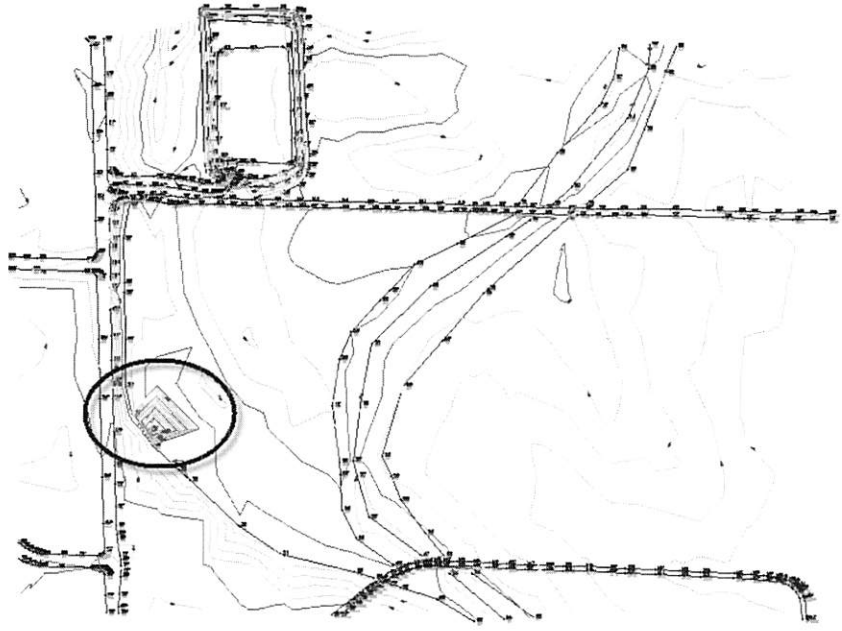


15. Back in the *Surface Manager* dialog box, click **<<Edit>>**.

16. In the *Edit TIN* dialog box set the **Edit Mode** to **Set Elevation**.

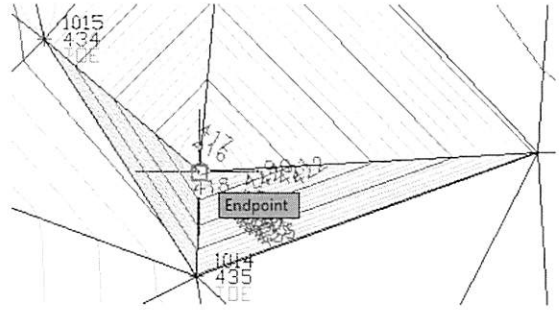
The triangular mesh is drawn temporarily in the drawing.

17. Zoom in to the area circled in the graphic below. It contains a point with an elevation error resulting in a hole and incorrect contours.



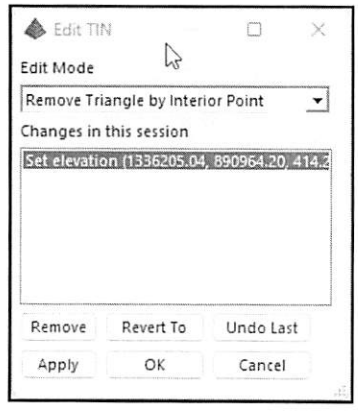
18. Pick near the vertex at the bottom of the hole.

19. The current elevation of 414.2742 is displayed. At the command line enter and a new elevation of **434.5**. Press **Enter**.



The TIN surface is instantly edited and re-contoured.

It is important to note that although the TIN is edited in this manner, the underlying point data is not affected. In cases where the point itself needs to be modified, this can be done in one of the coordinate file utilities such as Elevation for Points.



20. Back in the *Edit TIN* dialog box set the **Edit Mode** to **Remove Triangle by Interior Point**.

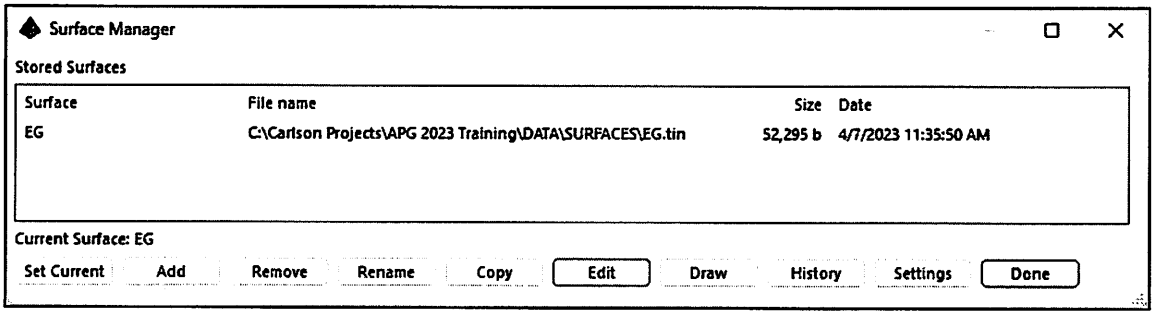
Surface Triangles should normally only be removed at the edges of the surface not within the body of the surface. Since you employed the *Shrink-Wrap Perimeter Reduction* option to have the *Triangulate and Contour* command automatically generate an *Inclusion Perimeter* to

eliminate extraneous triangles from the outer limits of the surface area, the is likely little or no need to erase any more, the following steps are here only to have you try this option.

21. Zoom to the edge of the surface and pick inside one of the outermost triangles.

22. Observe the effect on the TIN and contours.

23. Press **Enter** to end this editing session.



24. Back in the surface manager, click **<<Done>>**.

25. Notice the triangulation lines are removed, but the contours remain.

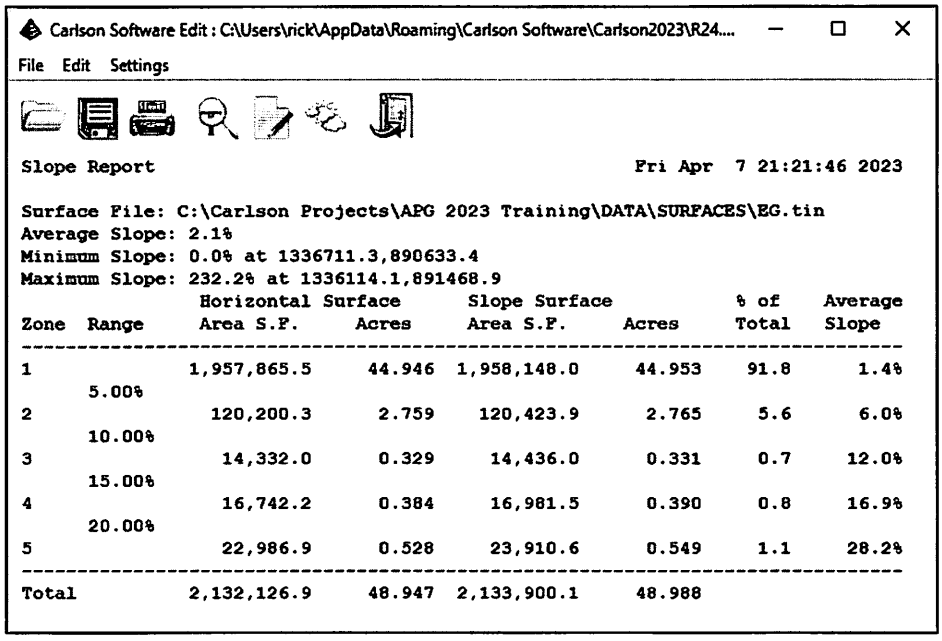
Lesson Review

In this lesson you learned how to edit *Surfaces* with the *Triangulation Surface Manager*. You adjusted the properties to display the contours at different intervals. Then you used the edit commands to correct the elevation of a point in the *Surface* and delete triangles from the edge of the *Surface*.

4.7 Lesson: Surface Inquiries

Introduction

Once a surface is created in Carlson, there are a number of commands available to get information from the surface. These include the use of the Quick Profile command, Spot Elevation by Surface Model command, for inquiry and labeling, and the Slope Zone Analysis command.



Carlson Software Edit : C:\Users\rick\AppData\Roaming\Carlson Software\Carlson2023\R24....

File Edit Settings

Slope Report Fri Apr 7 21:21:46 2023

Surface File: C:\Carlson Projects\APG 2023 Training\DATA\SURFACES\EG.tin
Average Slope: 2.1%
Minimum Slope: 0.0% at 1336711.3,890633.4
Maximum Slope: 232.2% at 1336114.1,891468.9

Zone	Range	Horizontal Surface Area S.F.	Acres	Slope Surface Area S.F.	Acres	% of Total	Average Slope
1		1,957,865.5	44.946	1,958,148.0	44.953	91.8	1.4%
	5.00%						
2		120,200.3	2.759	120,423.9	2.765	5.6	6.0%
	10.00%						
3		14,332.0	0.329	14,436.0	0.331	0.7	12.0%
	15.00%						
4		16,742.2	0.384	16,981.5	0.390	0.8	16.9%
	20.00%						
5		22,986.9	0.528	23,910.6	0.549	1.1	28.2%
Total		2,132,126.9	48.947	2,133,900.1	48.988		

Key Concepts

Concepts and key terms covered in this lesson are:

- Quick Profile
- Spot Elevation Labeling
- Slope Zone Analysis

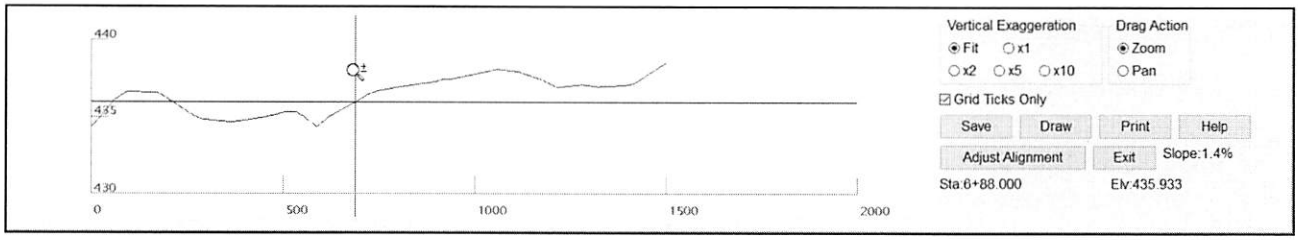
Objectives

After completing this lesson, you will be able to:

- Generate a Quick Profile of a Surface
- Add Spot Elevations based on a Surface
- Perform Slope Zone Analysis of a Surface

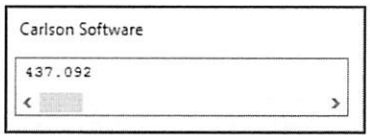
Quick Profile

Quick Profile samples a Surface in real time and displays the results in a separate viewing window at the bottom of the drawing editor.



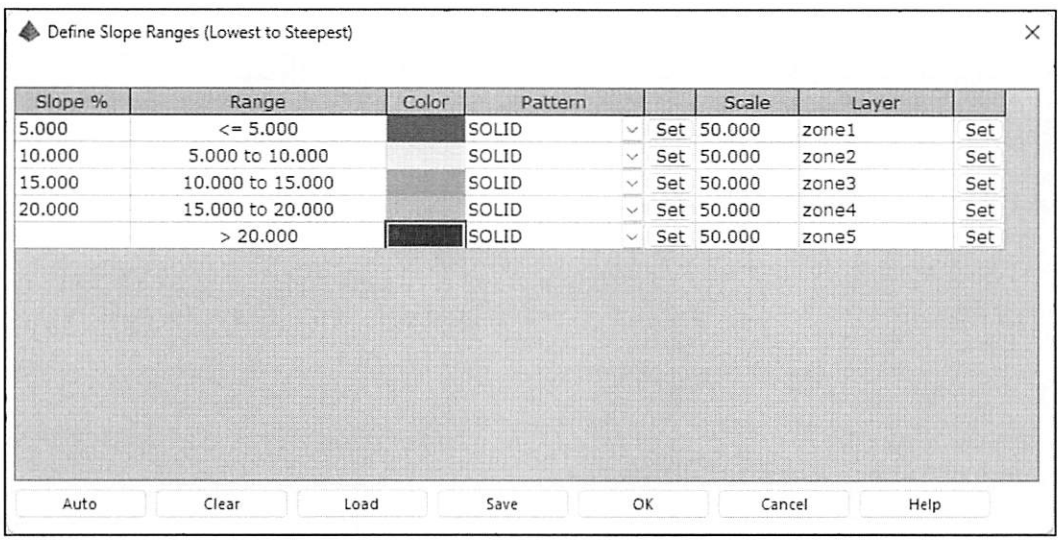
Draw Spot Elevations

Spot Elevation labels are added to the drawing, and a floating dialog interface displays the elevation of the surface at the cursor location in real time.



Slope Zone Analysis

Slope Zone analysis is performed on a Surface, dividing it into user specified ranges, reporting the results, and coloring the drawing based on the analysis.


Define Slope Ranges (Lowest to Steepest)
Slope % | Range | Color | Pattern | | Scale | Layer |
5.000 | <= 5.000 | SOLID | Set | 50.000 | zone1 | Set
10.000 | 5.000 to 10.000 | SOLID | Set | 50.000 | zone2 | Set
15.000 | 10.000 to 15.000 | SOLID | Set | 50.000 | zone3 | Set
20.000 | 15.000 to 20.000 | SOLID | Set | 50.000 | zone4 | Set
> 20.000 | SOLID | Set | 50.000 | zone5 | Set
Auto
Clear
Load
Save
OK
Cancel
Help

Drawing Inspector

The Drawing Inspector has an option to display a Surface Elevation at the cursor popup menu.

Exercises: Surface Inquiry with Quick Profile, Spot Elevations and Slope Zones

In these exercises you get more information about a Surface using various methods to investigate it.

You do the following:

- Generate a Quick Profile of a Surface
- Draw Profile
- View and Label Spot Elevations from a Surface
- Perform a Slope Zone Analysis of a Surface with Color Coding

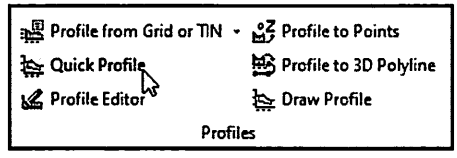
4.7.1 Quick Profile

1. Continue working in the drawing **Surface.dwg**.

If you have not completed the previous lessons:
Open *4_7.dwg* from the project folder *APG 2023 Lesson 4_7*.

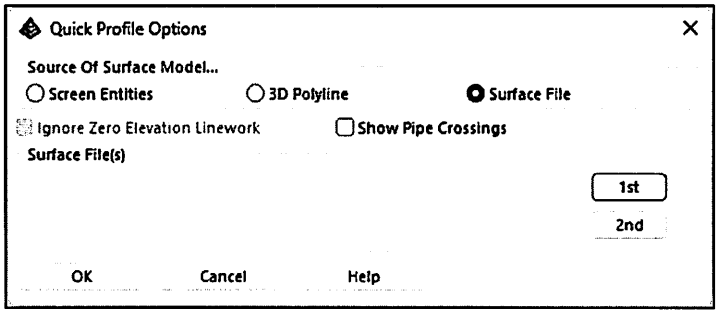
2. Draw a polyline with three or four vertices across the surface.

3. Select **Ribbon: Surface ⇒ Profiles ⇒ Quick Profile.**



Alternatively, from the pull-down menu:
Select **Surface ⇒ Quick Profile.**

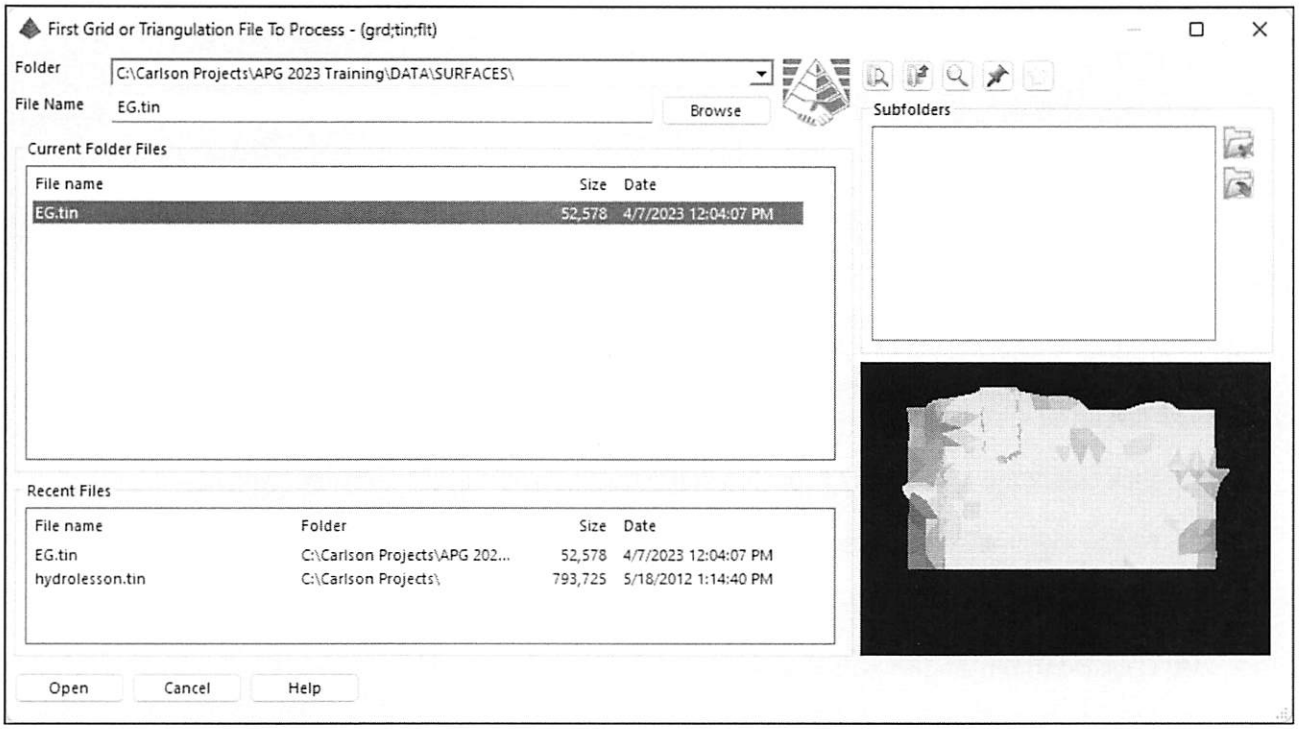
The *Quick Profile Options* dialog box opens.



4. Set the **Source of Surface Model** to **Surface File.**

5. In the *Surface File(s)* section click **<<1st>>.**

The *Select Surface File* dialog box opens.

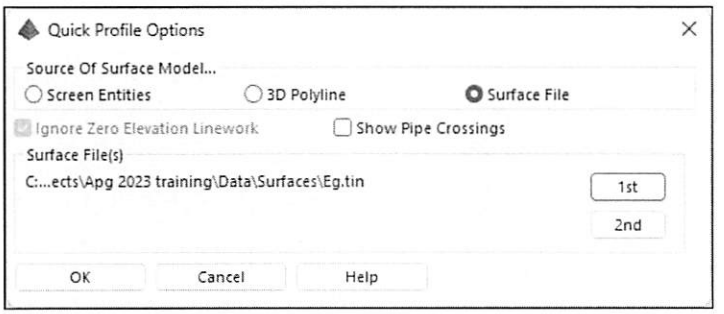


6. Select the file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\EG.tin**

If this file is in your list of *Recently used files*, select it from there, it will be faster than browsing for it.

If you have skipped previous lessons and did not create the .TIN file you can browse for a copy:
C:\Carlson Projects\APG 2023 Lesson 4_7\Data\Surfaces\EG.tin

7. Click **<<Open>>**.

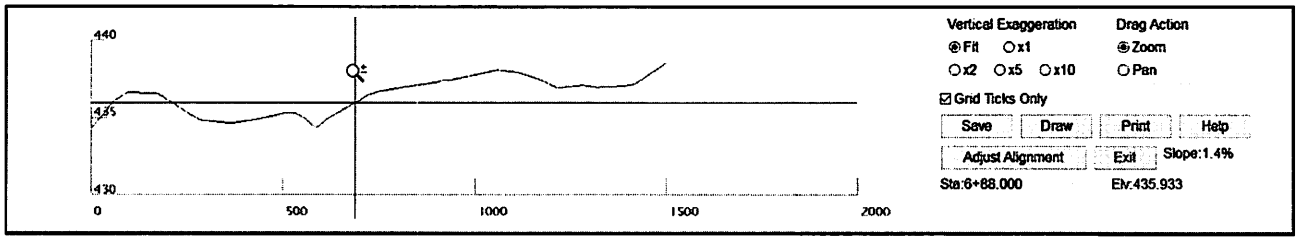


8. Back in the *Quick Profile Options* dialog box, click **<<OK>>**.

9. At the command prompt type **P** for Polyline.

10. Pick the polyline you just drew.

11. A profile of the surface along the polyline is instantly generated in a new window at the bottom of your screen.

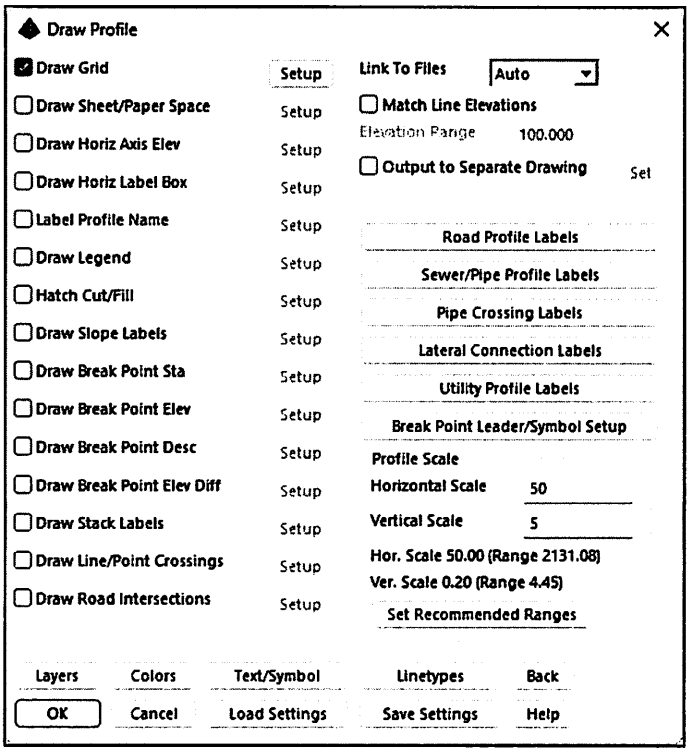


12. Click **<<Adjust Alignment>>**.

Small plus marker symbols are displayed at the vertices of the polyline and small triangle symbols are displayed at the mid-points of the segments.

13. Pick one of the triangles to select the entire polyline and move it within the surface.
14. Notice the profile responds in real-time to the movement of the polyline.
15. Pick again to set it to a new location of the polyline.
16. Click **<<Adjust Alignment>>** again.
17. Pick one of the plus marker vertex symbols to adjust the location of just that vertex.
18. Notice again the profile responds in real-time.
19. Click **<<Draw>>**.

The Draw Profile dialog box is displayed.

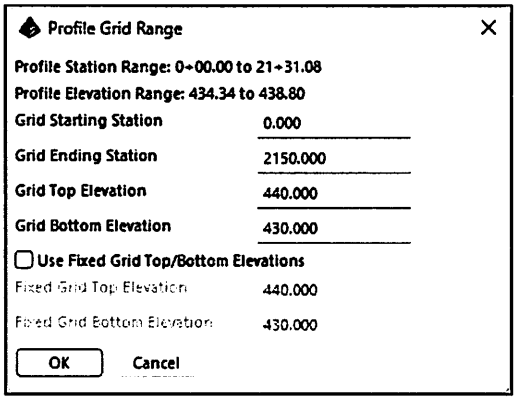


20. Set the **Horizontal Scale** to **50**.

21. Set the **Vertical Scale** to **5**.

22. Click **<<OK>>**.

23. In the *Profile Grid Range* dialog box, click **<<OK>>** to accept the defaults.



A rectangle representing the size of the profile is displayed on your cursor.

24. Pick a location to draw the profile in the drawing.

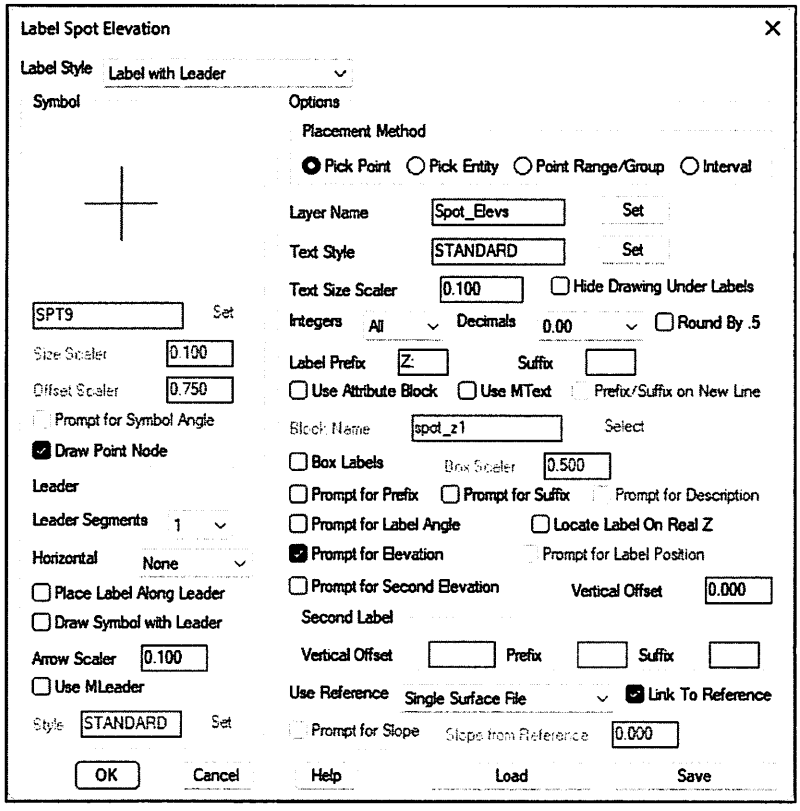
Note: In the Quick Profile command, the Save button saves both a .PRO (Profile file) and a .CL (Centerline file). If you are going to adjust the polyline that the profile is generated from, it is recommended to Save before adjusting it.

4.7.2 Creating Spot Elevations

1. Continue working in the drawing from the previous exercise.

2. From the pull-down menu:
   Select **Surface ⇒ Spot Elevations ⇒ Draw Spot Elevations**
   or
   Select **3D Data ⇒ Spot Elevations ⇒ Draw Spot Elevations.**

The *Label Spot Elevation* dialog box opens.



3. Set the **Label Style** to **Label with Leader.**

4. Set the **Placement Method** to **Pick Point.**

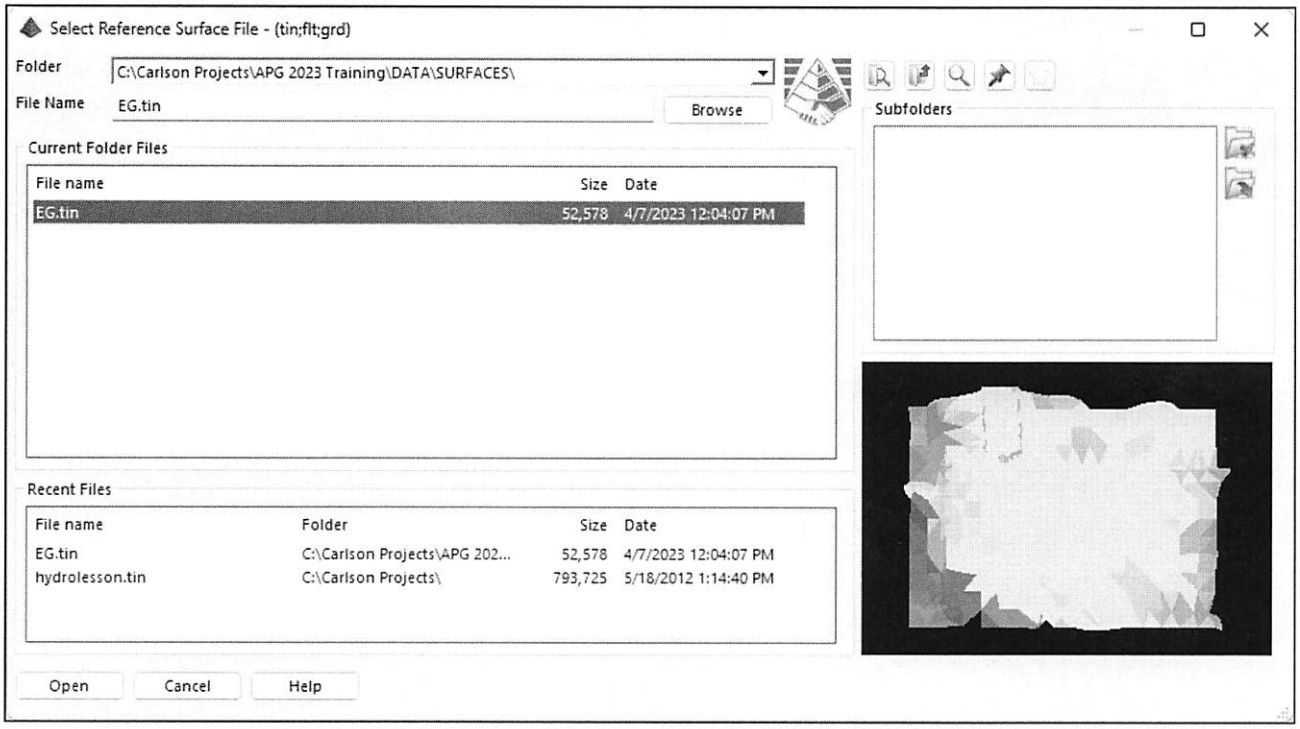
5. Enter **Spot_Elevs** for the **Layer Name.**

6. Set the **Use Reference** to **Single Surface File.**

7. Enable the **Link to Reference** option.

8. Click **<<OK>>.**

The *Select Surface File* dialog box opens.



9. Select the file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\EG.tin**

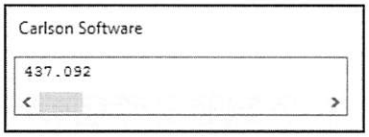
If this file is in your list of *Recently used files*, select it from there, it will be faster than browsing for it.

If you have skipped previous lessons and did not create the .TIN file you can browse for a copy: **C:\Carlson Projects\APG 2023 Lesson 4_7\Data\Surfaces\EG.tin**

10. Click **<<Open>>**.

11. A floating dialog displays the surface elevation as you move your cursor around the surface.

12. Pick a location in the drawing to generate a spot elevation. Pick a second point to indicate the end of the leader.



A spot elevation label is created in the drawing at the location you picked.

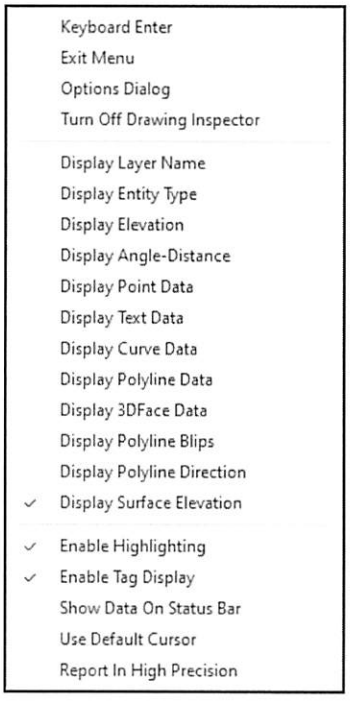
13. Press **Enter** to end the command.

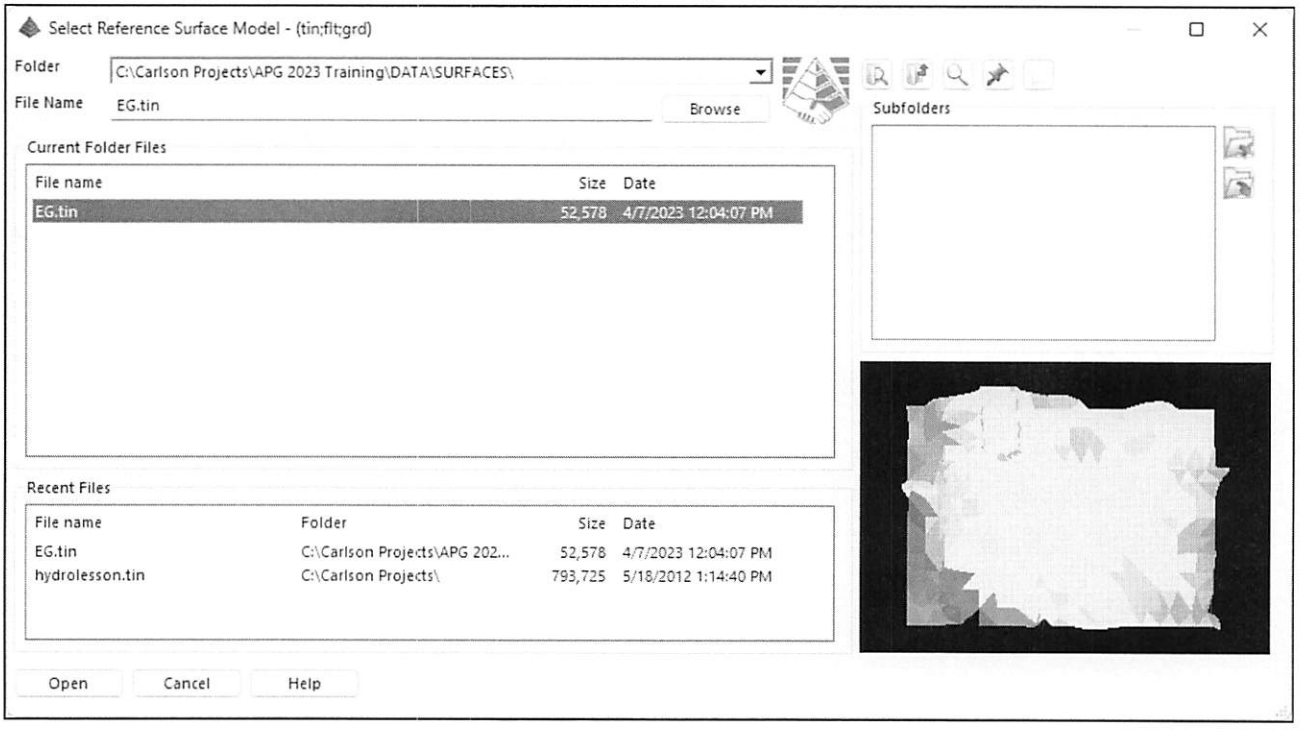
4.7.3 Using the Drawing Inspector to show Surface Elevation

1. Continue in the drawing from the previous exercise.
2. Select **Ribbon: Draft ⇒ Inquiry ⇒ Drawing Inspector.**

Alternatively, from the pull-down menu:
Select **Inquiry ⇒ Drawing Inspector On/Off.**

3. Right-click to show the drawing inspector options.
4. Disable all Display options.
5. Enable **Display Surface Elevation**.



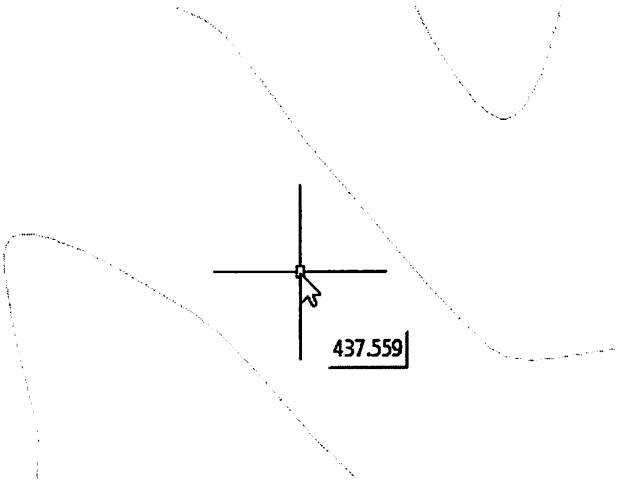


6. Select the file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\EG.tin**

If this file is in your list of *Recently used files*, select it from there, it will be faster than browsing for it.

If you have skipped previous lessons and did not create the .TIN file you can browse for a copy:
C:\Carlson Projects\APG 2023 Lesson 4_7\Data\Surfaces\EG.tin

7. Click **<<Open>>**.
8. Hover over the surface to see the elevation at that location based on the .TIN file.
9. When finished, right-click and select **Turn Off Drawing Inspector.**

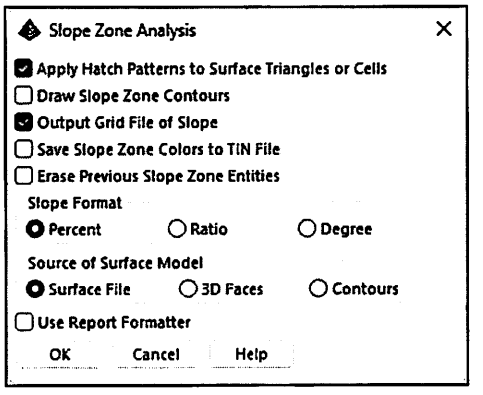


4.7.4 Slopes Zone Analysis

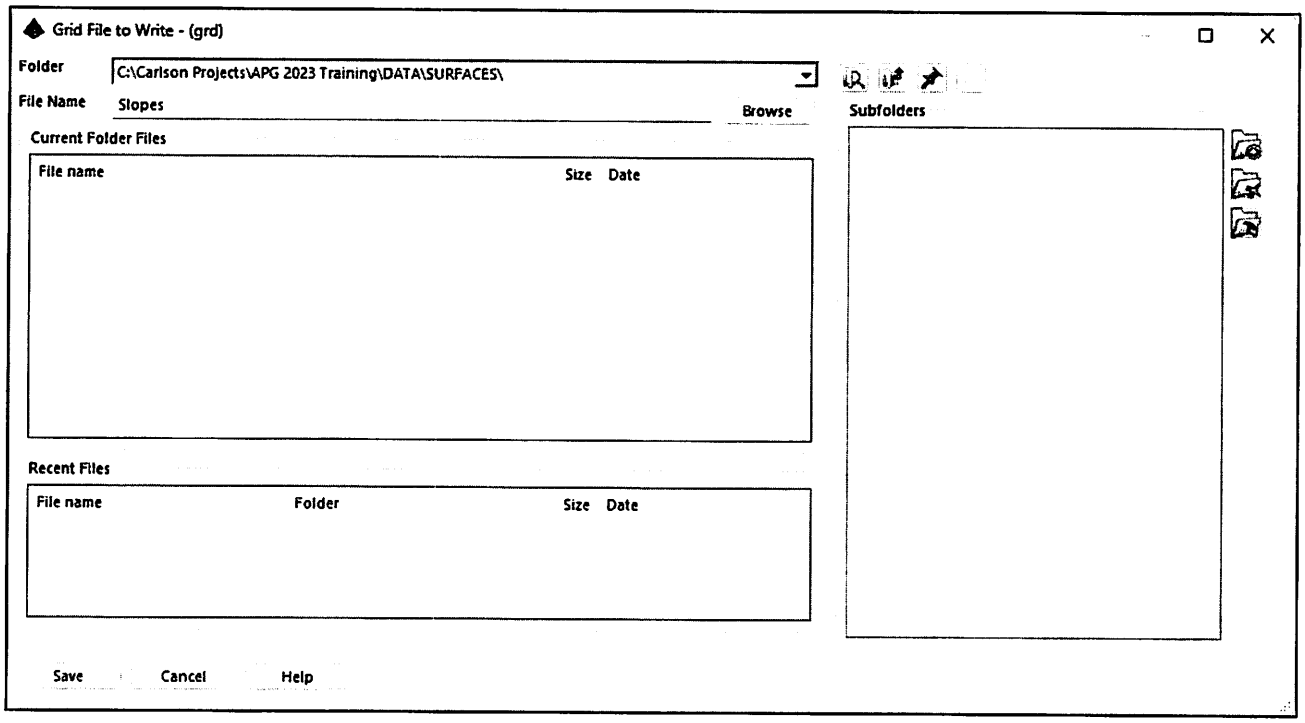
1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu:
   Select **Surface ⇒ Slope Analysis ⇒ Slope Zone Analysis.**

The *Slope Zone Options* dialog box opens.

3. Enable the option to **Apply Hatch Patterns to Surface Triangles or Cells**.
4. Disable the option to **Draw Slope Zone Contours**.
5. Enable the option to **Output Grid File of Slope**.
6. Set the **Slope Format** to **Percent**.
7. Set the **Source of Surface Model** to **File**.
8. Disable the option to **Use Report Formatter**.
9. Click **<<OK>>**.



The *Name of Grid File to Write* dialog box opens.

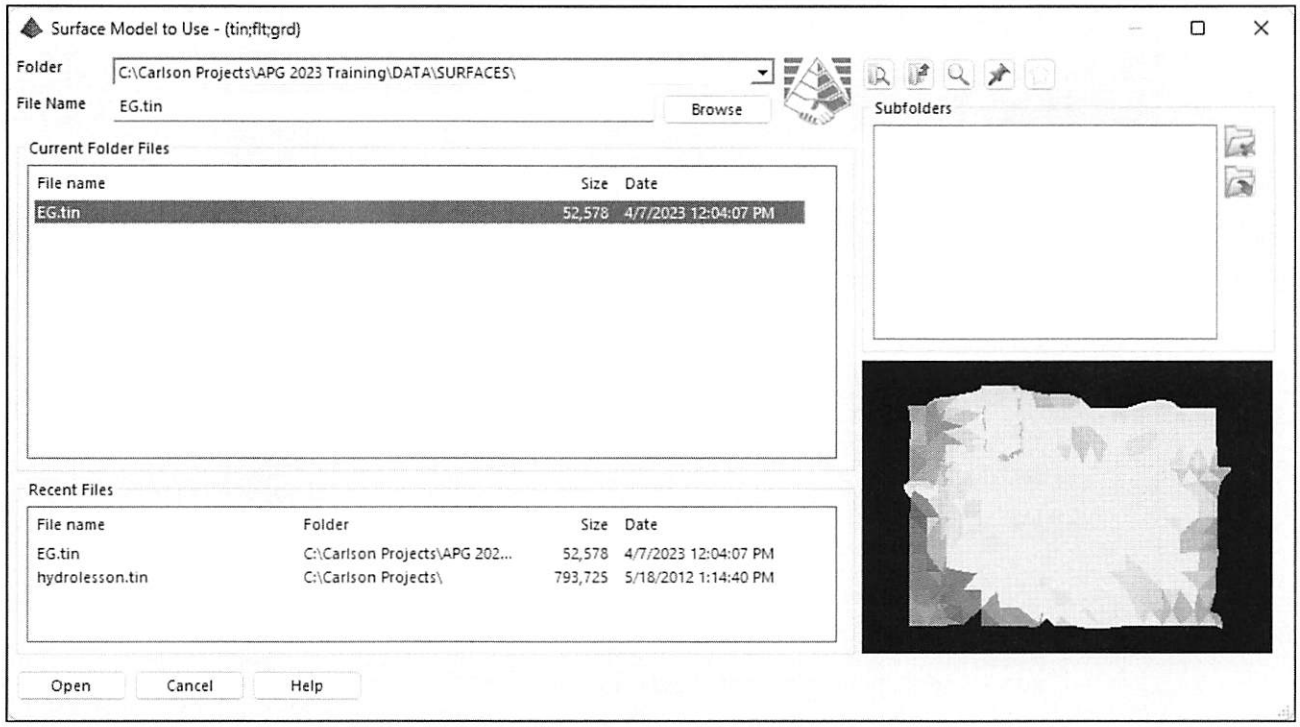


10. Create a new file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\Slopes.grd**

If you have skipped previous lessons and did not create the project above, create a new file: **C:\Carlson Projects\APG 2023 Lesson 4_7\Data\Surfaces\Slopes.grd**

11. Click **<<Save>>**.

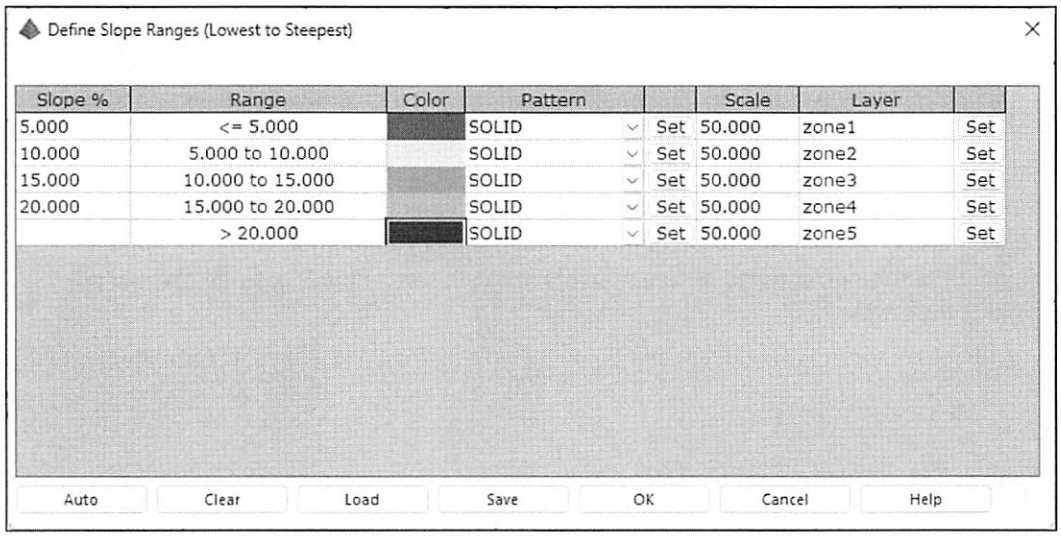
The *Select Surface File* dialog box opens.



12. Select the file: **C:\Carlson Projects\APG 2023 Training\Data\Surfaces\EG.tin**

If you have skipped previous lessons and did not create the .TIN file you can browse for a copy:
C:\Carlson Projects\APG 2023 Lesson 4_7\Data\Surfaces\EG.tin

13. Click **<<Open>>**.



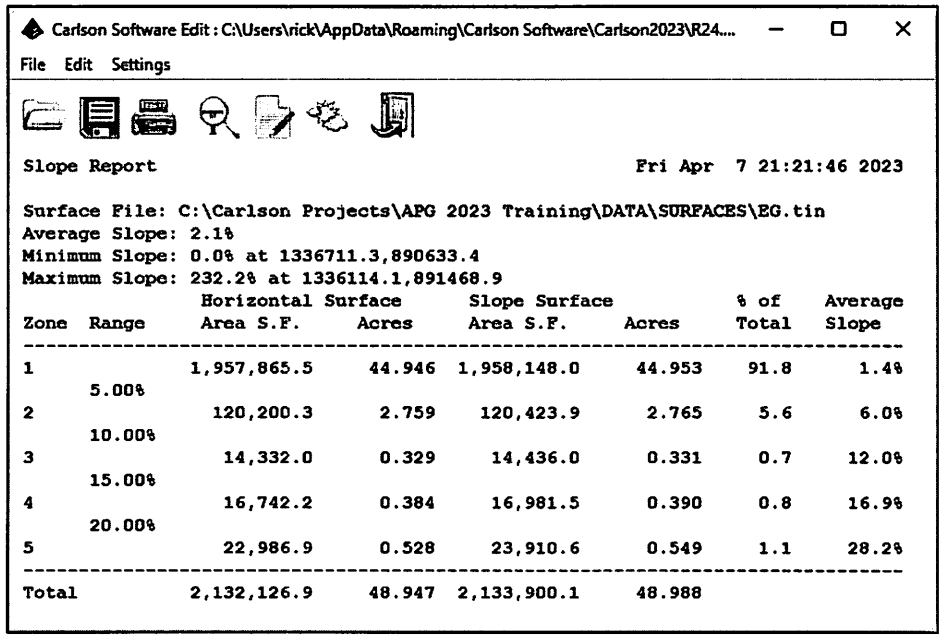
14. In the *Define Slope Ranges* dialog box, enter 5 percent ranges up to 20 percent as shown above.

15. Click **<<OK>>**.

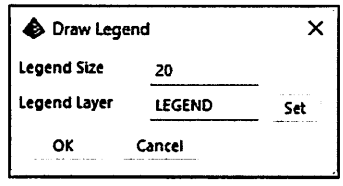
16. At the command line, press **Enter** to skip defining an inclusion perimeter.

17. At the command line, press **Enter** again to skip defining any exclusion perimeters.

A report of the breakdown of the surface into the designated slope ranges is displayed.


Carlson Software Edit : C:\Users\rick\AppData\Roaming\Carlson Software\Carlson2023\R24....
File Edit Settings
Slope Report Fri Apr 7 21:21:46 2023
Surface File: C:\Carlson Projects\APG 2023 Training\DATA\SURFACES\EG.tin
Average Slope: 2.1%
Minimum Slope: 0.0% at 1336711.3,890633.4
Maximum Slope: 232.2% at 1336114.1,891468.9
Zone Range Horizontal Surface Area S.F. Acres Slope Surface Area S.F. Acres % of Total Average Slope
1 1,957,865.5 44.946 1,958,148.0 44.953 91.8 1.4%
5.00%
2 120,200.3 2.759 120,423.9 2.765 5.6 6.0%
10.00%
3 14,332.0 0.329 14,436.0 0.331 0.7 12.0%
15.00%
4 16,742.2 0.384 16,981.5 0.390 0.8 16.9%
20.00%
5 22,986.9 0.528 23,910.6 0.549 1.1 28.2%
Total 2,132,126.9 48.947 2,133,900.1 48.988

18. Click **<<Exit>>** when you are finished reviewing the report.
19. Pick a location in the drawing for the legend.
20. Set the **Legend Size** to **20**.
21. Click **<<OK>>**.



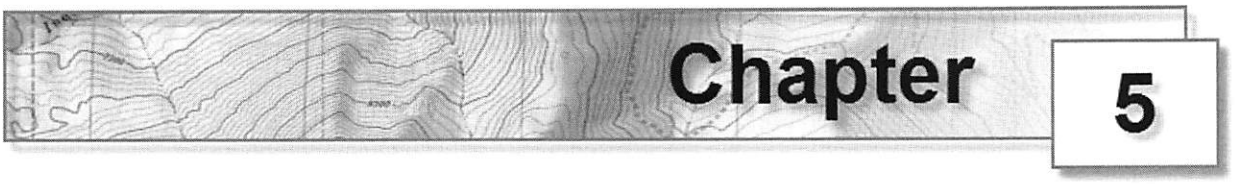
The surface is now color-coded to represent the slope ranges specified.

Lesson Review

In this lesson you learned several ways to perform inquiries about Surface models. First you learned to create and edit a *Quick Profile* of the surface. Then you learned to dynamically track the elevation of the surface and create spot elevation labels. Finally, you preformed a slope analysis of the surface.

Chapter Review

In this Chapter you learned many tools to prepare Surface Data, create Surfaces, View Surfaces, Contour Surfaces, Label Contours and perform Surface Inquiries. A solid and versatile knowledge and capability of Surface Modeling is essential to the successful implementation of *Carlson Software*.



5 - Basic CAD Drawing and Editing in Carlson Software

Introduction

In addition to the thousands of commands and functions within the Carlson desktop application product line that are designed to accomplish tasks specific to civil engineering, land surveying, hydrology, mining, estimating, and other disciplines, there are also a full complement of commands and functions designed to accomplish basic CAD drafting and editing demands.

While the Draw and Edit menus provide access to standard/conventional versions of many of these tools, the Carlson versions and variations are also often specifically fine-tuned for the civil/survey disciplines. The lessons contained in this chapter are designed to familiarize you with many of the commonly used commands and tools, but do not in any way profess to cover all of those possible in CAD or Carlson. This chapter will help you gain an understanding of where to find other commonly used commands and help you develop a comfort level in their basic operation. A working knowledge of CAD applications needs to be developed in order to reach maximum drawing and editing efficiency.

Lesson: Introduction to Basic CAD Drawing and Editing Tools

In this lesson, you learn the principles of drawing and editing and some of the concepts associated with Carlson Software.

Lesson: Basic CAD Drawing and Editing

In this lesson, you learn to draw and edit through a tutorial designed to familiarize you with many of the basic Carlson commands as well as several shortcuts.

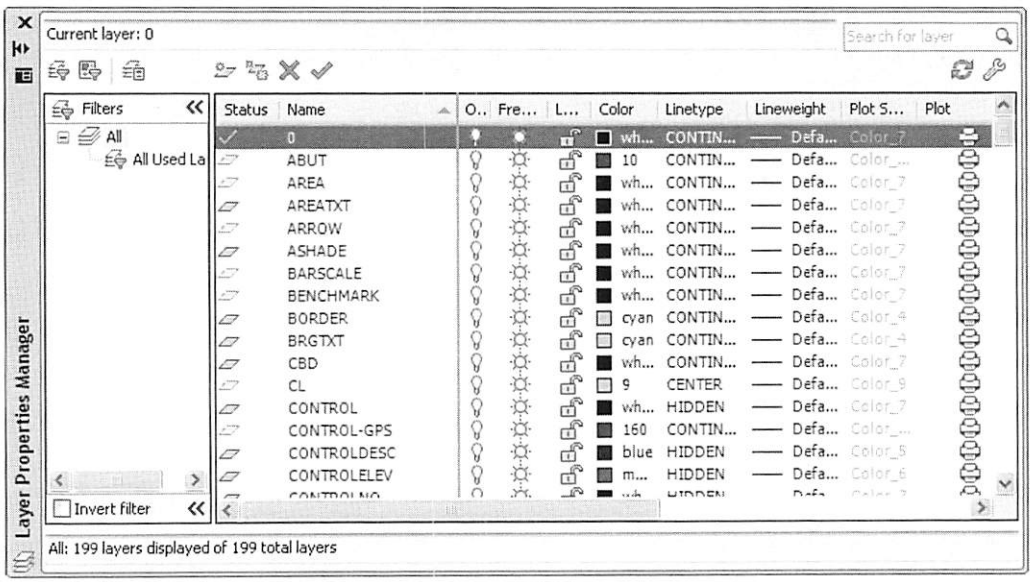
Lesson: Cosmetic Enhancements and Creating a Final Plan

In this lesson, you learn to add information to create a final plan while considering drafting standards to be employed throughout.

5.1 Lesson: Introduction to Basic CAD Drawing and Editing

Introduction

It is important to understand how Carlson approaches the process of drawing and editing. In a sense, drawing and editing, although often included in distinctly different commands, are very much tied together. Each command is either creating or modifying an entity within a drawing. Each entity carries with it information that can be used in various other commands. This lesson will introduce you to many of the concepts and operational functions of the Carlson drawing and editing commands.



Key Concepts

Concepts and key terms covered in this lesson are:

- What types of CAD drawing and editing tools are in Carlson
- Where the Drawing and Editing tools are located
- Entering accurate data to create CAD entities
- Setting up and using templates and other drawing standards
- Short cuts and tips on drawing and editing
- The difference between standard CAD versions of basic drawing and editing commands and the Carlson variations on these tools

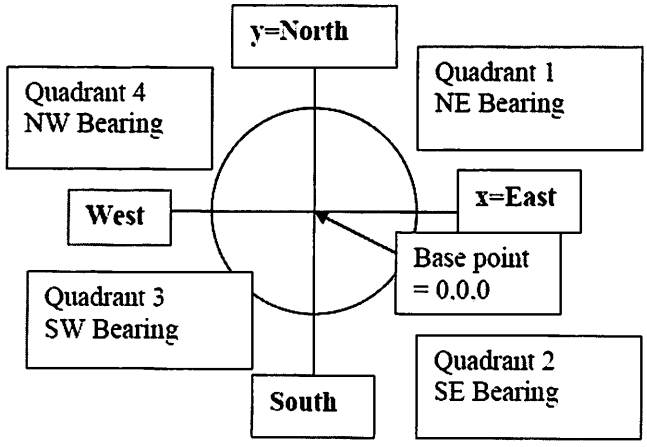
Objectives

After completing this lesson, you will be able to:

- Understand the concepts of drawing and editing objects in Carlson
- Understand how to enter data to accurately create CAD entities
- Learn tips on drawing and editing more efficiently

Drawing Coordinate Base and Rotation

An important aspect to Carlson is that it operates on a "real life" coordinate base. The base point of the drawing file is at X,Y,Z = 0,0,0 with north coinciding with the Y axis and east with the X axis. Z of course is the elevation. Carlson software does NOT allow a user to randomly select a base point and north rotation inconsistent with AutoCAD's coordinate base. In instances where you are using a file created by another software platform where such a rotation has been made, Carlson, in most cases, will recognize the coordinate base and rotation disconnect, and prompt you to rectify the situation. This is very important in today's world of GPS locations and geo-referenced data.



Entering Angles

When entering directional commands, Carlson utilizes the typical entry of quadrant numbers. These numbers start in the northeast quadrant and proceed clockwise [northeast = 1; southeast = 2, southwest = 3; northwest = 4.]

Further numeric angle entry is as follows

- 5 = north azimuth
- 6=angle left
- 7=angle right
- 8=deflection left
- 9=deflection right

Entering Lines, Polylines and Arcs

Lines, polylines and arcs can be entered into drawings essentially through 3 methods (other than those created through specific command functions):

- by Picking – two or more points on the screen such as field located points (nodes), end points of lines, center of circle etc. using your Object Snap (Osnap in AutoCAD) or Entity Snap (Esnap in IntelliCAD) function or in a completely random fashion.
- by point number– All Carlson Commands allow user input of point numbers for any points contained in a linked CRD file. The point numbers are entered at the command line prompt.
- by prompts - following a particular Carlson routine in which a prompt is given for additional information pertaining to that entity

Working with 3D and 2D Data

An important aspect to understand about Carlson software is that it will work in a true 3D environment if configured that way. That is, data such as points, 3D lines and 3d polylines are placed in the drawing file at their actual elevation. For example, if a point is imported into the drawing with the coordinates N 5000.00 E 5000.00 Z 100.00 the point will be placed in the horizontal position of 5000,5000 and at an elevation of 100.

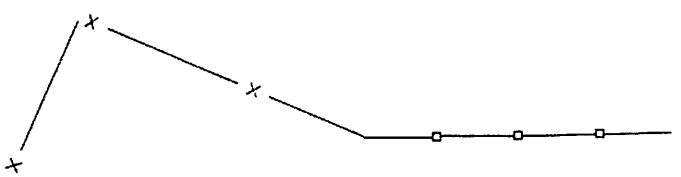
The option to place points in the drawing at their real elevation is controlled with the *Locate on Real Z Axis* setting as show below.

The default condition for Carlson is to draw in 3D. The significance of this is that any line, polyline or symbol placed at that location will likewise be placed at that elevation.

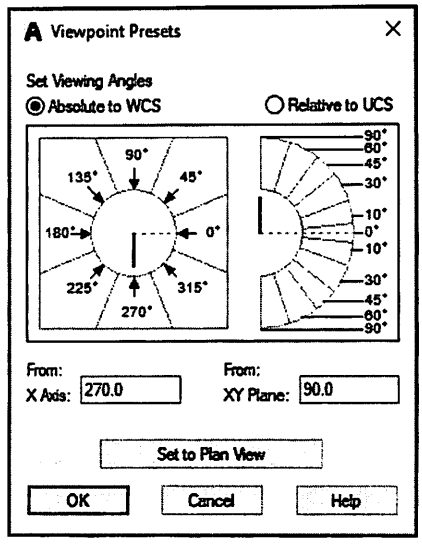
Drawing using 3D entities is not new to Carlson or AutoCAD for that matter, but many users have opted not to engage that part of the program, instead drawing strictly in a 2 dimensional environment. There are many advantages to working in 3D. Break lines are recognized by Carlson with no further manipulation, the design process is greatly enhanced as all entities contain complete geometrical data, information can be queried directly from an entity without executing special programs and most advanced CAD platforms are designed with the use of 3D data in mind. The chapter *"Working With Surfaces"* is an example of how Carlson handles 3 dimensional entities.

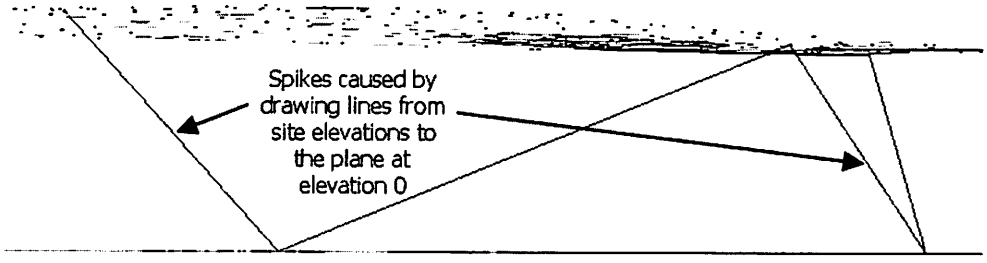
The issue arises when a designer/drafter unknowingly uses traditional AutoCAD 3D elements and places them at elevations from the point data without taking in account the effect this will have on the surface. For example: an AutoCAD line is drawn starting from a node at elevation 100.00 to a distance 50' away at a point with elevation 0. The line would create a "spike" from elevation 100 to 0 causing a hole in the surface model. Likewise points and blocks copied around a drawing using the traditional AutoCAD copy command, would be adding elevations throughout the surface model that may not be desired.

There are, however many times when it is best to use a 2D object. Many Linetypes for instance, will not look as desired when created as a 3D entity. For example: when setting a linetype to a resemble various fence lines, a 2D line or polyline must be used.



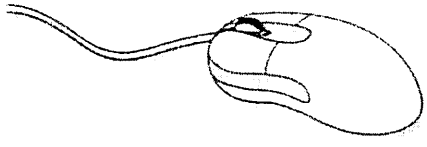
By using viewpoint 3D under the view menu and setting the XY plane to 0, you will quickly be able to see which entitles are drawn in 3D or 2D and identify any vertical irregularities.

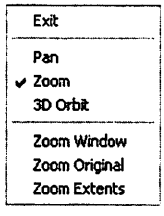




Learning to think and draw in a 3 dimensional world will greatly increase productivity as well as reduce errors. However, there is a great deal of planimetric data that needs to be created on a 2 dimensional plane (elevation 0), such as title blocks, notes, and horizontal layout elements. This chapter will focus on 2D drawing tools that will create 2 dimensional entities while eliminating the possibility of unwanted 3D data.

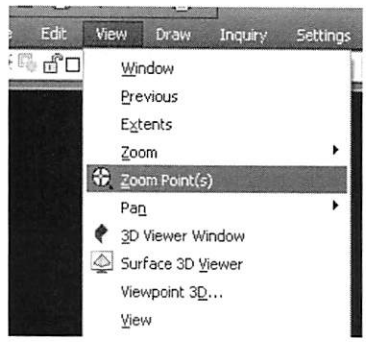
Moving around a drawing





It is very important to become familiar with the display commands available in Carlson, most of which are the same as in any AutoCAD or IntelliCAD platform. Depending on the hardware you are using, many shortcuts to these commands may be configured such as setting a scroll button to zoom in/zoom out or setting the right click button to display an alternate menu. Also dependent on the platform you are using, the settings for these configurations vary in menu location but are typically under the settings menu.

Carlson does include some enhanced zoom features such as Zoom Point(s) found under the View Menu. This command allows you to simply enter any point number found in the CRD file and the program will zoom to that point at a preset magnification height.



Many users find it helpful to enable the Zoom toolbar for easy access to common used view functions.

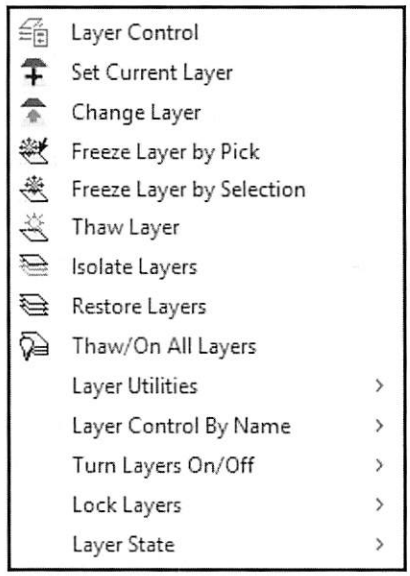
To enable a toolbar, right click on any existing toolbar and scroll through the list of available toolbars checking those desired.

Controlling the Display

Keeping a drawing clean and well organized is not only essential for workflow efficiency but is also critical for maintaining accuracy. Drawing entities on the wrong layer is one of the quickest ways to potential problems. A gas line erroneously placed on a water line layer can cause problems beyond that of an incomplete plan.

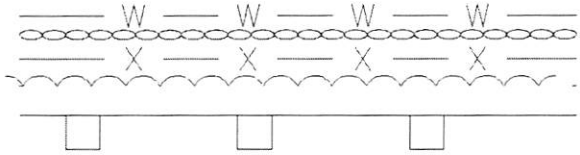
Carlson offers several tools for added control beyond that of straight AutoCAD functions. These tools are found under the View Menu pulldown. Of particular mention are:

- **Set Layer** - sets the current layer by picking any object on the desired layer
- **Freeze Layer by Pick** - freezes a layer by simply picking any object on that layer.
- **Isolate Layers** - isolates a single layer by selecting any object on that layer
- **Restore Layers** - restores all layers from the isolate command
- **Layer State** - allows you to save and restore a set of layers much like AutoCAD's Layer State command but with the capability of storing layer sets externally which can then be used to standardize drawings

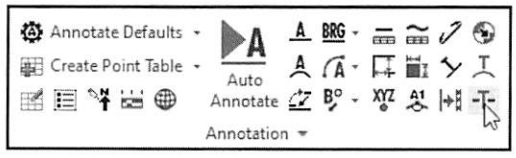


A toolbar with many of these commands are also available and can be enabled for frequent use.

Special Line Types

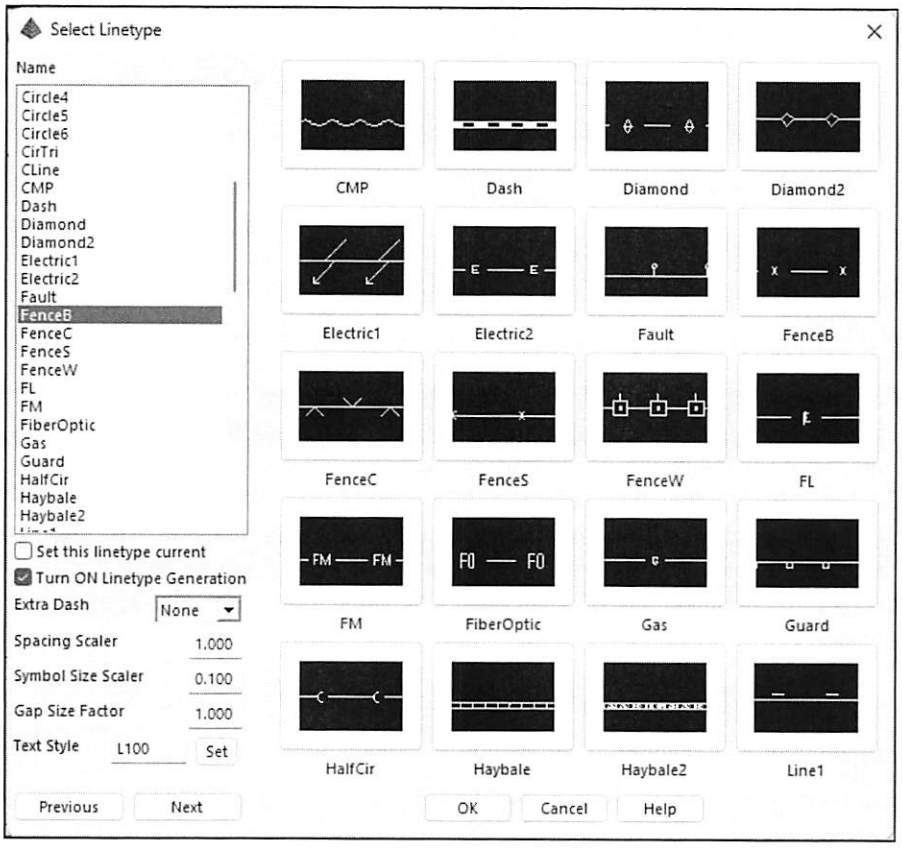


Most all companies employ some type of standards when it comes to plan preparation. These standards usually include things like line types and symbols that are used to represent utilities or other field information.

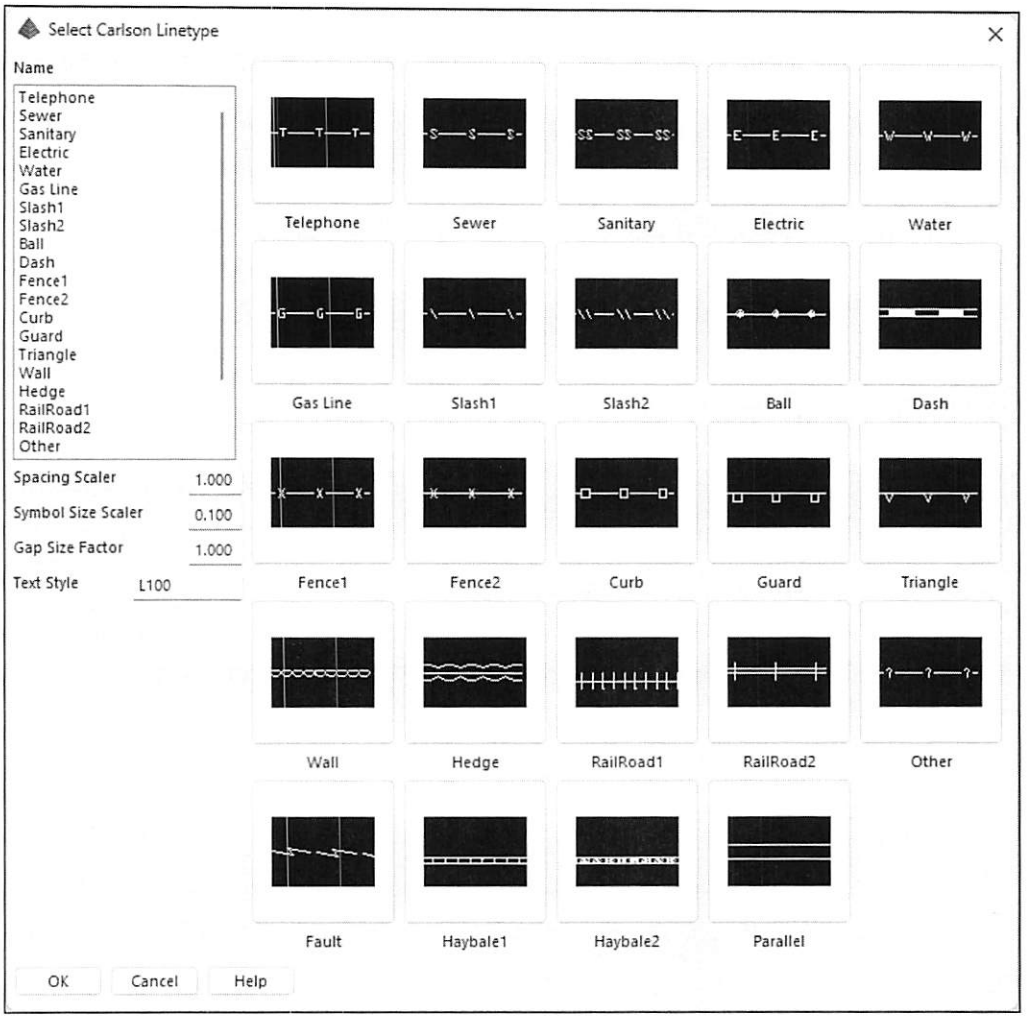


The Carlson special line types are found under the Annotate Pull-down Menu or the Annotation panel on the Annotation tab of the Ribbon; and essentially create line types in two different manners using two different commands; **Change Polyline Linetype** and **Polyline to Special Line**. In either case, a 2D polyline must be drawn first at the desired location.

Change Polyline Linetype - creates a specific linetype while preserving the characteristics of the polyline it was created from. This is especially useful when the polyline will be offset or used for dimensioning for the plan. The spacing, symbol size and gap can all be controlled in the *Change Linetype* dialog box.



Polyline to Special Line - similar in execution, this command creates special lines by eliminating the underlying polyline and replacing it with a series of lines and symbols.



Standards and Templates

As previously mentioned, most all companies employ some type of drafting standards when preparing a plan. A first step in setting up these standards is through the use of a drawing template, a **DWT** file. At a minimum, a drawing template file should contain all the layers normally used when drafting a plan. Each of these layers has a designated color which corresponds to a line width which is saved externally in a **CBT** file which in turn is selected when printing the plan. Using this process ensures each plan will be consistent in appearance when printed. Because each company or individual user works in such an independent fashion and each Unser Interface is configured differently the following example is meant as a brief overview.

Using a Drawing Template

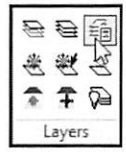
In this exercise you will become familiar with the process of setting up and using a drawing template. (DWT)

Set up a drawing template

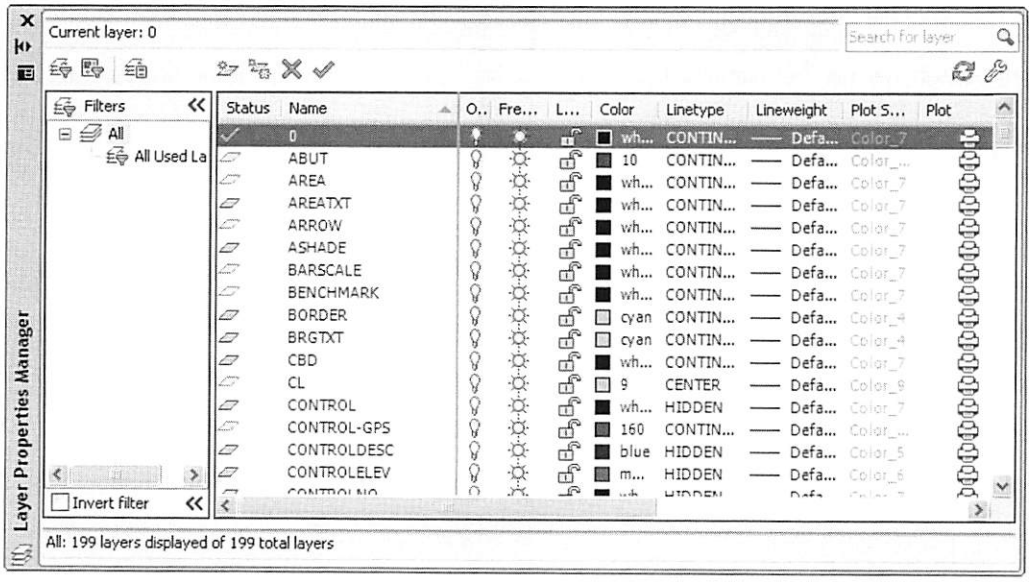
1. Create a new drawing or open an existing drawing that does not contain graphic information.

One option is to use the drawing template *acad.dwt* to create an empty blank drawing.

2. Select **Ribbon: Draft ⇒ Layers ⇒ Layer Control**



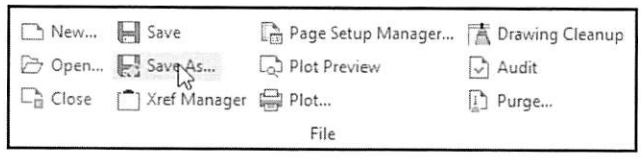
Alternatively, from the pull-down menu
Select **View ⇒ Layer Control**



3. In the *Layer Properties Manager* dialog box, create desired layers with associated colors and linetypes.

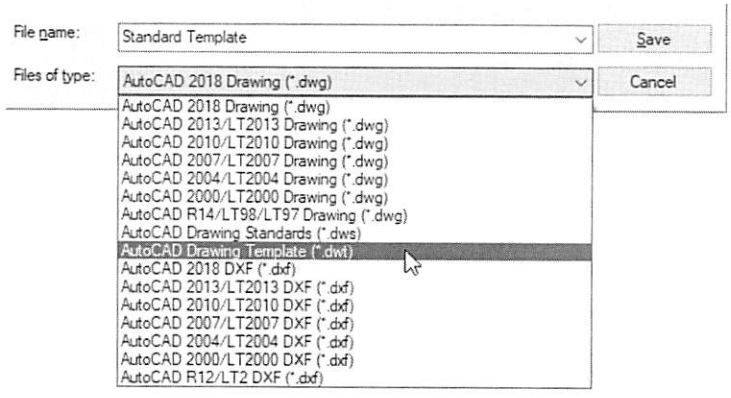
4. As an option, add notes, plan border, title block or other graphic information that is commonly used during plan preparation.

5. Select **Ribbon: File ⇒ Saveas**



Alternatively, from the pull-down menu:
Select **File ⇒ SaveAs.**

6. From the bottom drop-down arrow, select the file extension **DWT**.

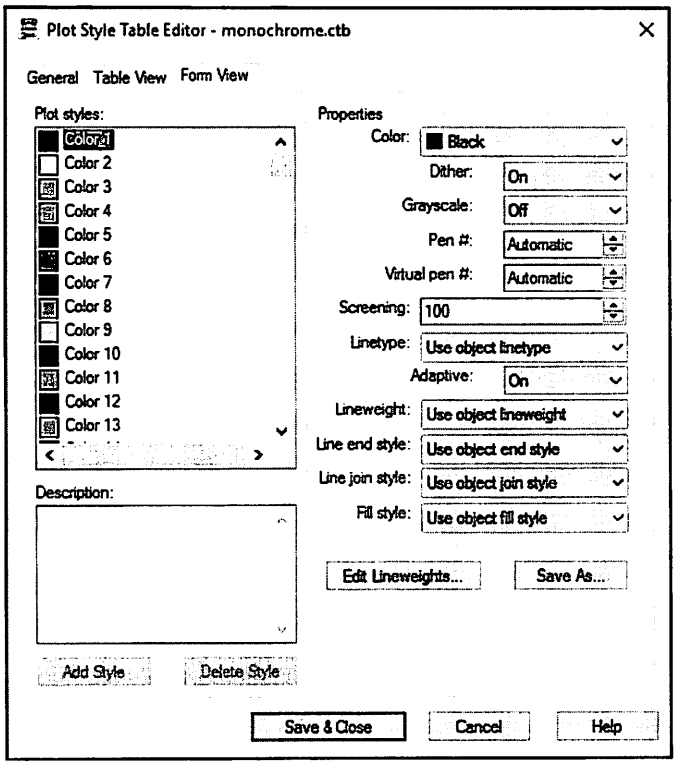


A standard installation of Carlson sets the drawing template file location locally on your C drive. In an environment with multiple users, it is advisable to set this to a Network location so all users have access.

After a template has been created, you can select it each time you create a new drawing. The new drawing will be created containing all the data from the template. The idea of using a template when you start a drawing is to ultimately save you time and promote standardization. Some users create a different template for each drawing scale, while others create a single template for all in house projects. Still others create templates for each of their individual clients. In any case, using templates is a great time saver and well worth the time investment of setting them up in advance.

Printing

The process of setting up and printing is specific to which CAD installation you are using, which plotter you are using and how you have decided to implement your drawing standards. The most common method is by using Plot Styles. A Color-dependent Plot Style table CTB is a file that contains specific information relating each color in CAD to the output of the plotter. In the Plot Style Editor you can dictate a variety of effects, the most often used being Color, Line Width and Screening.



Another method of controlling the output of a drawing is a Named plot style table (STB). When you use a named plot style table, you apply a user defined plot style to each object or layer which means the same color in a drawing can look different when plotted.

Examples in this book deal only with a CTB file.

In a company setting, the CTB or STB file is created and stored on a network server for access by all users. This ensures that a drawing can be printed from any computer and have the same output result.

Blocks

An element in CAD that is oftentimes confusing is the Block. A Block is simply elements like lines, arcs or text grouped together into a single object. The block can contain any number of entities within it and can be stored within the drawing itself or "written" externally to a location on a local computer or network. When a Block is "written" to an external location, it carries an extension of DWG. Therefore, editing an external block can be performed identically to any other drawing. Most symbols used in Carlson are Blocks that are stored in an external location and then added to the *Carlson Symbol Library*. Utilizing these blocks is demonstrated later in this book.

Blocks can also contain attributes which appear to be text but have more advanced functions. Each attribute can be associated with a block but can also be edited independently from that block. The attributes can also be extracted and utilized in other applications such as an external data base. Carlson Points are an example of a Block containing attributes. *See Chapter 3 Working With Points for detailed examples of working with Carlson point attributes.*

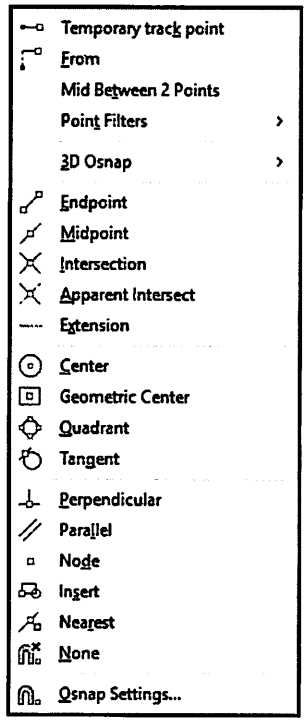
Blocks are extremely useful and can be used in a variety of manners. Blocks can be used to create symbols, title blocks, construction details, notes or any number of planimetric elements. When Blocks are stored externally as a DWG (drawing) file, they can be inserted into any other drawing, eliminating the need to re-create the same information. The Carlson Symbol Library is a great example of storing, organizing and using Blocks in an efficient manner and is covered in the chapter "Ten Essential Tools". Using an external Block is also addressed in this chapter.

Drawing with accuracy

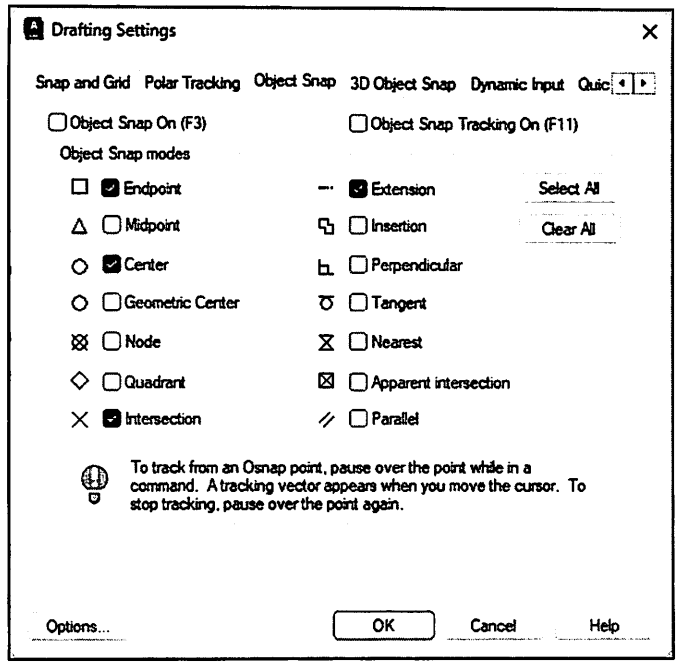
One of the most important aspects to drawing is ensuring the accuracy of the objects drawn and how they are connected to one another. Apart from the points in the coordinate file, the integrity of the objects is controlled by the exact beginning point, end point, midpoint, center etc. of each object. A drawing can look neat and well-presented but have serious errors in it due to improperly drawn entities. The use of object or entity snaps (Osnap or Esnap) is the best way to ensure that you are drawing accurately.

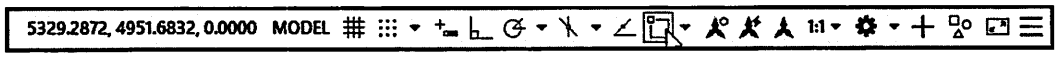
When connecting one object to another *Snapping* to that specific point is accomplished by enacting an Osnap or Esnap override in two manners, **On demand** or **running**.

On demand – during a command such as drawing a line press and hold the "shift" button and "right click" on your mouse. A drop down box appears on the screen displaying the available Osnaps. Slide the cursor down the box and pick to select the desired Osnap. Move the cursor near the point on the object, such as the end point of a line, and a yellow colored box (a magnet) will snap to the exact endpoint of the line.



Running Osnaps – you can preset Osnap overrides to run continuously. For example if you have several end points to connect, preset the endpoint button to **Endpoint** prior to initiating the command. The running osnaps can be toggled on and off by using the **[F3]** button at the top of the key board. To set the osnap overrides. Hold the shift button and right click the mouse as above, then scroll to the bottom and select Osnap Settings. Alternatively, hover over the Icons at the bottom of the screen and click the Osnap Settings button.



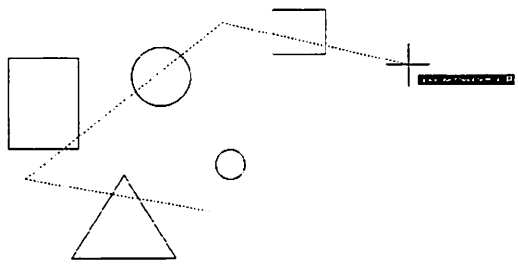


It is generally not recommended to set too many running Osnaps at once. You may get undesired results in areas where objects are close to each other or overlapping.

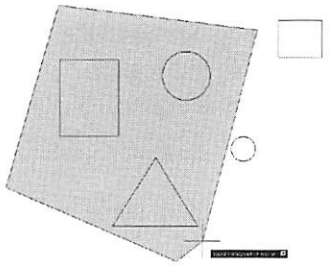
Tips on Selecting Objects

Selecting objects is one of the more overlooked features in CAD. When selecting an object or objects for commands such as *Move*, *Erase*, *Copy*, *Rotate* etc., most users are familiar with selecting an object individually or by a window. Here are a couple of less known selection methods that can save a lot of time

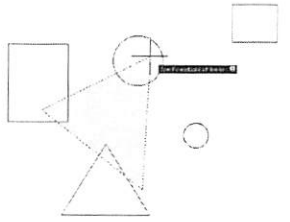
Fence – selection by **Fence** is performed by entering **F** after the command is issued, then drawing an imaginary line over the objects desired. Anything that the imaginary line touches will be included in the selection set.



Window polygon – similar to selection by window, **Window Polygon** selects everything included within the defined area but is not limited to a rectangular shape. By typing **WP** at the command prompt you can define an irregular shaped polygon for an inclusion set.



Crossing polygon – similar to a window polygon, Crossing Polygon selects everything within the defining polygon as well as anything the outermost limits touch. Type **CP** at the command prompt



Lesson Review

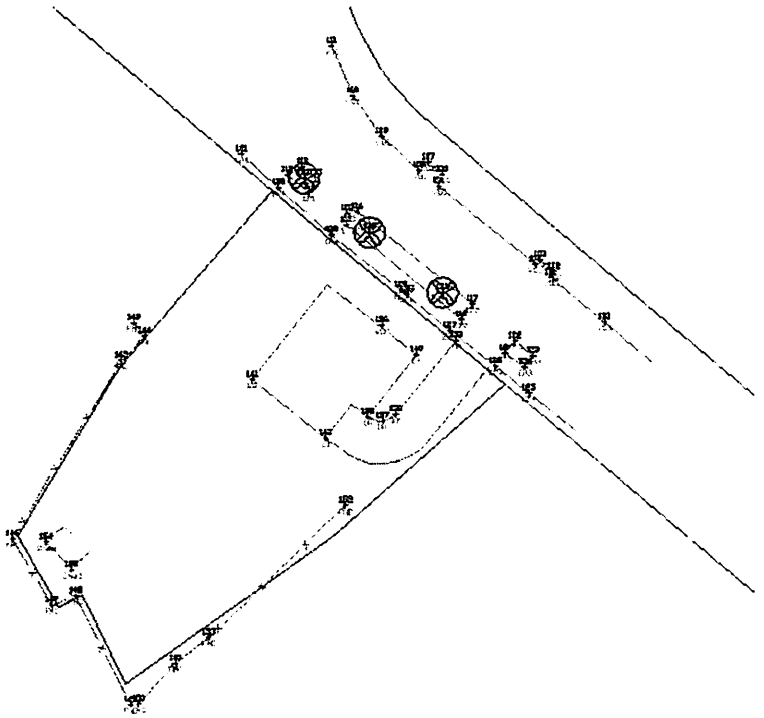
In this lesson you were introduced to some of the basic tools for drawing and editing in Carlson. Carlson contains many commands within each drawing or editing menu as well as a multitude of options for each command when executed. You are encouraged to take some time and experiment with each command to become familiar with them and learn they can be implemented into your daily work flow.

In the next lessons and exercises you will use some of these commands in a step by step tutorial.

5.2 Lesson: Basic Cad Drawing and Editing

Introduction

Carlson has many advanced tools for importing and editing data, designing a site and automating much of the drafting work. There are also drafting tools available for some of the more basic drawing and editing needs, such as drawing lines, arcs and text. In this lesson you will follow a tutorial introducing you to many straightforward drawing and editing commands that invariably need to be used on every project.



Key Concepts

Concepts and key terms covered in this lesson are:

- Drawing lines polylines and arcs
- Drawing symbols
- Making special line types
- Using external drawing files

Objectives

After completing this lesson, you will be able to:

- Have an understanding of how to properly enter data for the creation of entities
- Use some short cuts to speed up drawing and editing
- Create special line types

Exercises: Creating a simple site plan using lines, polylines and arcs

In these exercises you will:

- Setup a supplied drawing
- Draw polylines by point groups, points and angle and distance
- Draw arcs
- Edit existing polylines
- Draw symbols
- Draw special lines
- Insert a DWG file

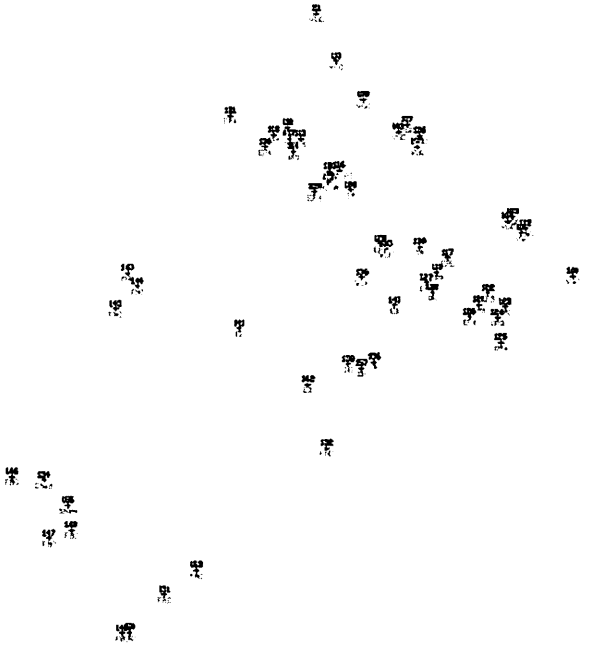
5.2.1 Initial Drawing Setup

Each user and/or company has their own standards for how a plan should look. The following tutorial will create a plan similar to the one shown above. Take note of steps along the way where you can employ your own standards.

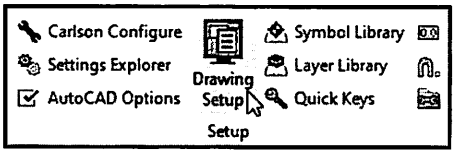
NOTE: Instructions for Downloading and Installing the Datasets can be found on page vi.

1. Open the drawing **C:\Carlson Projects\APG 2023 Lesson 5_2\DWGS\5_2.DWG.**

This drawing contains points 100-158 with various descriptions.

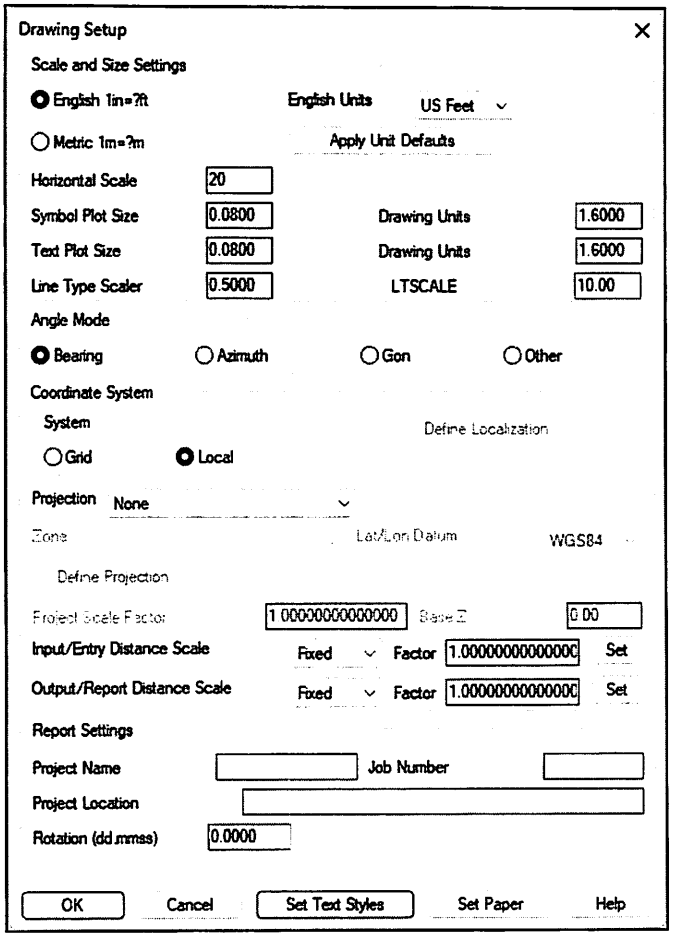


2. Select **Ribbon: Setup ⇒ Setup ⇒ Drawing Setup.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Drawing Setup.**

The *Drawing Setup* dialog box opens.

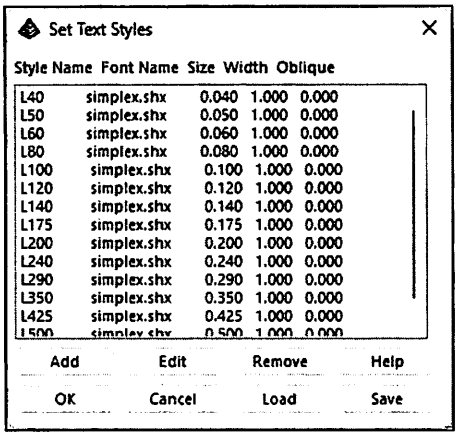


3. Set the **Horizontal Scale** to **1"=20'.**

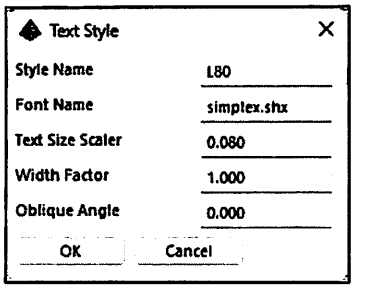
4. Click **<<Set Text Styles>>**

This opens the Set *Text Styles dialog* box

Note the named text styles and associated text size scalers. The text size scaler indicates the plotted text height. For example, an L80 text style will be plotted at a height of .08 inches.



Each Text Style can be created or edited by clicking **<<Add>>** or **<<Edit>>** followed by entering the style name and scaler.

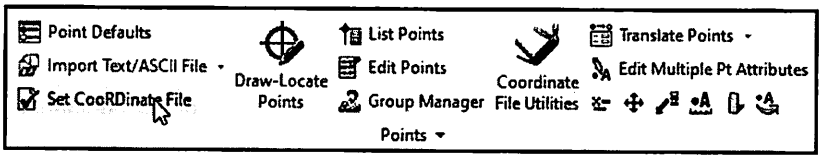


5. In the *Set Text Styles* dialog box click **<<OK>>** without making any changes.

The program creates the text styles shown in the dialog box by multiplying the set drawing scale and the Text Size Scaler. (ie. An L80 style at a drawing scale of 1"=20' will be 1.60' in height.)

6. Back in the *Drawing Set Up* dialog box, click **<<OK>>.**

7. Select **Ribbon: Points ⇒ Points ⇒ Set Coordinate File**



Alternatively, from the pull-down menu:
Select **Points ⇒ Set Coordinate File**

8. Confirm the Coordinate File to Process dialog box is set to Existing.

9. Browse and select the file **APG 2023 Lesson 5_2\Data\Points\5_2.CRD.**

10. Click **<<Open>>.**

11. Back in the drawing editor select from the pull-down menu:
Select **View ⇒ Zoom ⇒ Zoom Point(s).**

12. At the prompt *Find by point number or description [<Number>/Desc]?* **N**

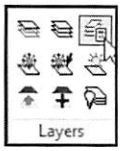
13. *Point number or range of point numbers to find <1>:* **138**

14. *Magnification or Height <303.96>:* **150**

The command zooms to the area of point 138.

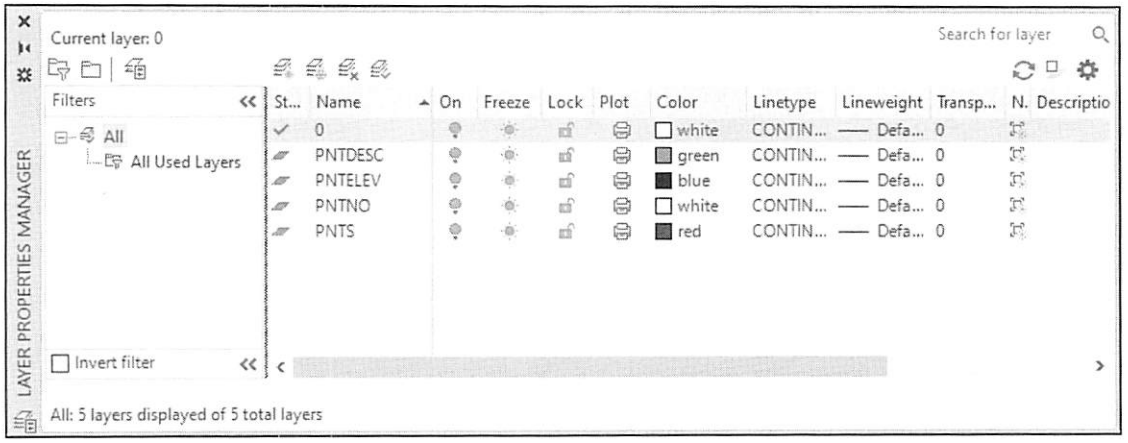
In this area, many points overlap each other making them hard to read. If desired, resize the points as described in the chapter *Working With Points.*

15. Select **Ribbon: Draft ⇒ Layers ⇒ Layer Control.**



Alternatively, from the pull-down menu:
Select **View ⇒ Layer Control**

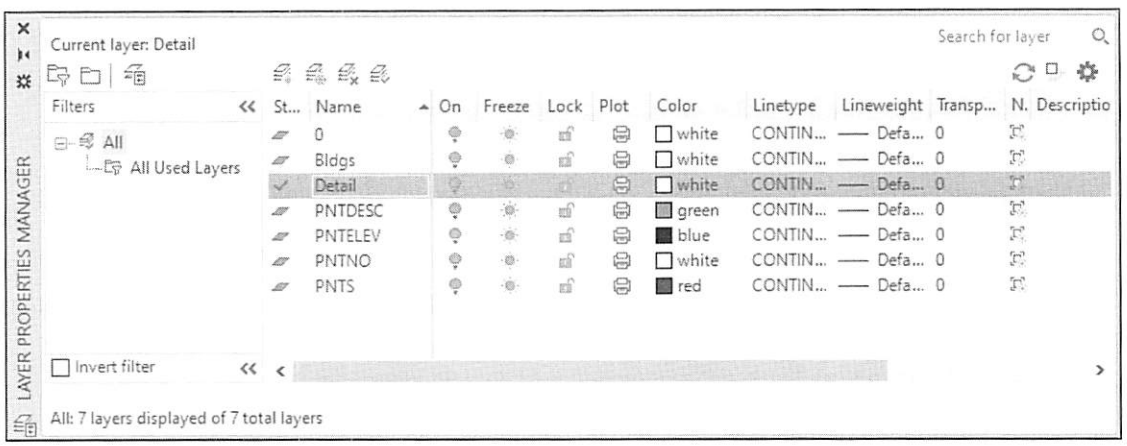
This opens *the Layer Properties Manager* dialog box.


Current layer: 0
Search for layer
LAYER PROPERTIES MANAGER
Filters
All
All Used Layers
Invert filter
St... Name On Freeze Lock Plot Color Linetype Lineweight Transp... N. Descriptio
0 white CONTIN... Defa... 0
PNTDESC green CONTIN... Defa... 0
PNTELEV blue CONTIN... Defa... 0
PNTNO white CONTIN... Defa... 0
PNTS red CONTIN... Defa... 0
All: 5 layers displayed of 5 total layers

16. Click the **<<New Layer>>** button located at the upper left of the *Layer Properties Manager* dialog box.

17. Create the layer **Bldgs**.

18. Repeat the above steps and create the layer **Detail.**


Current layer: Detail
Search for layer
LAYER PROPERTIES MANAGER
Filters
All
All Used Layers
Invert filter
St... Name On Freeze Lock Plot Color Linetype Lineweight Transp... N. Descriptio
0 white CONTIN... Defa... 0
Bldgs white CONTIN... Defa... 0
Detail white CONTIN... Defa... 0
PNTDESC green CONTIN... Defa... 0
PNTELEV blue CONTIN... Defa... 0
PNTNO white CONTIN... Defa... 0
PNTS red CONTIN... Defa... 0
All: 7 layers displayed of 7 total layers

19. Highlight the layer **Detail** and click the **<<Set Current>>** button.

The *Layer Manager* dialog box is where you can create and delete layers, apply colors, line types, freeze or thaw layers, create layer filters and save combinations of sets of layers to help ensure the consistence of plotting a drawing. This book does not go into great detail of working with layers but it is an essential base knowledge that each user needs to be able to work on any CAD platform.

20. When completed, close the Layer Properties Manager.

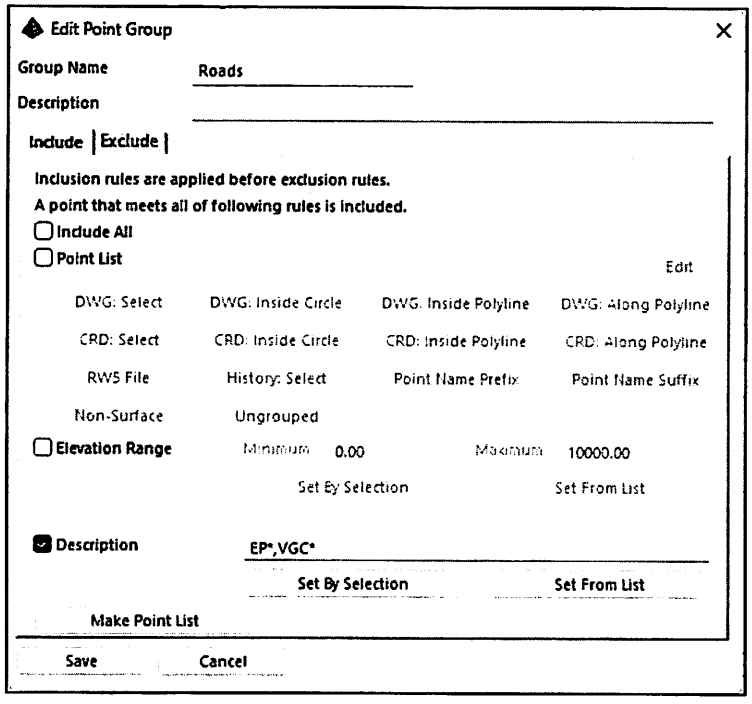
5.2.2 Drawing Polylines by Point Group

Previous exercises in the chapters on *Working with Points* and *Surfaces* demonstrated how to draw break lines and work with point groups. This exercise will further utilize the *Point Group Manager* to draw 2 dimensional polylines for planimetric details.

1. Continue working in the same drawing **5_2.DWG.**
2. Confirm that the current layer is set to **Detail.**
3. Select **Ribbon: Points ⇒ Points ⇒ Group Manager.**

Alternatively, from the pull-down menu:
Select **Points ⇒ Point Group Manager**

4. In the *Point Group Manger*, click **<<Create>>.**

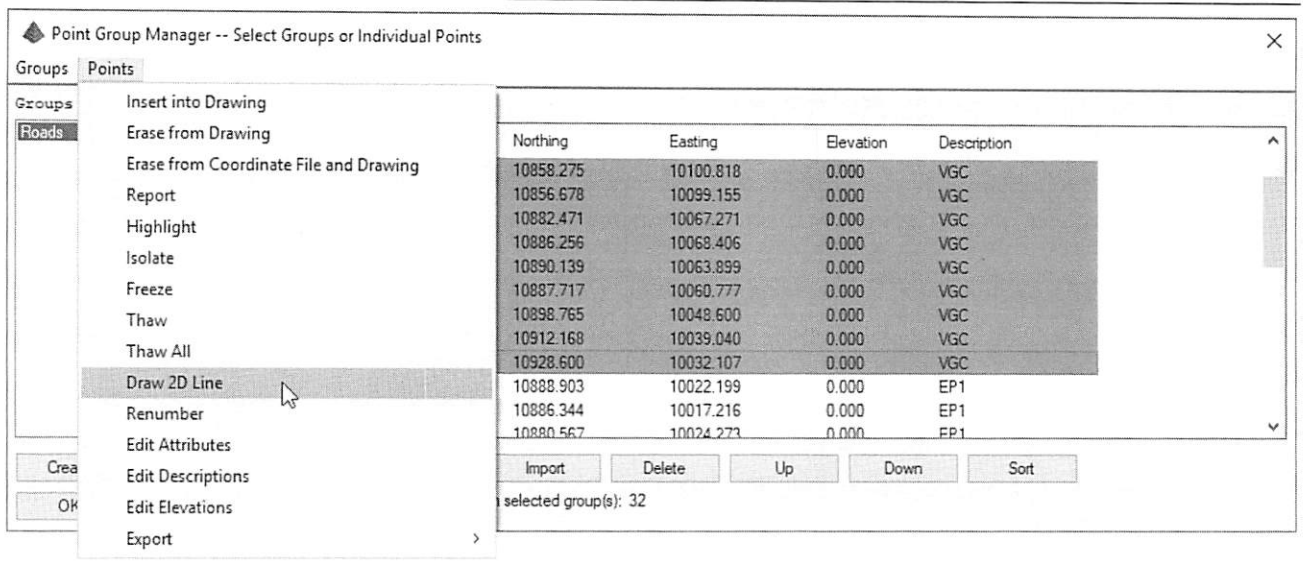


5. Create a point group with name **Roads** containing points with the descriptions **EP*** and **VGC***.

See the chapter *Working with Points* for more information on point groups.

Note: the * after a description is a wildcard and will include any points that contain extra characters after the initial description.

6. Click **<<Save>>**



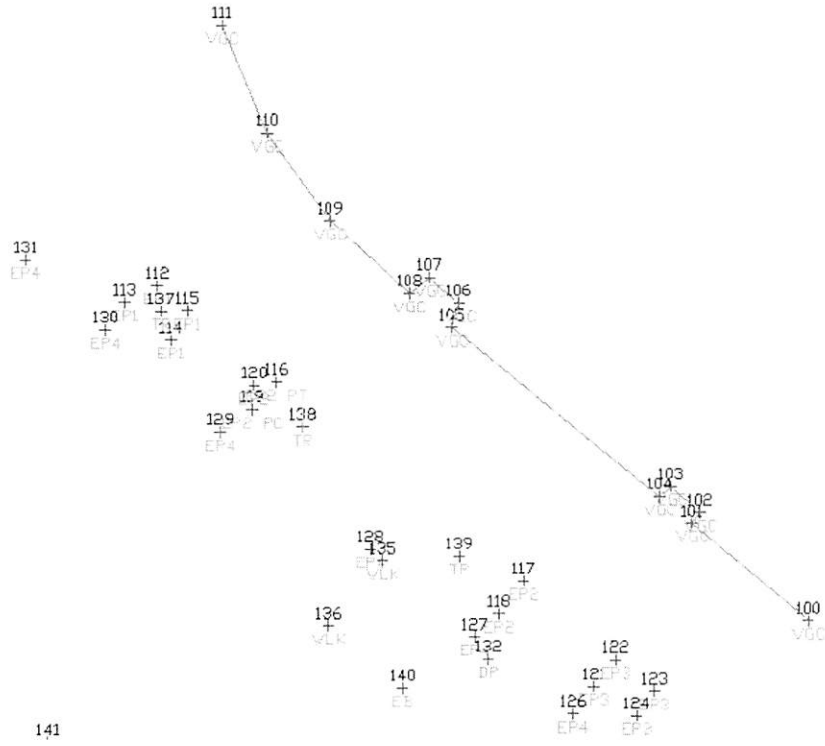
7. In the *Point Group Manager* dialog box, select all the points containing the description VGC (vertical granite curb).

Make the selection by holding the shift button on the key board while highlighting the first point and last point on the list. All points in between will be selected.

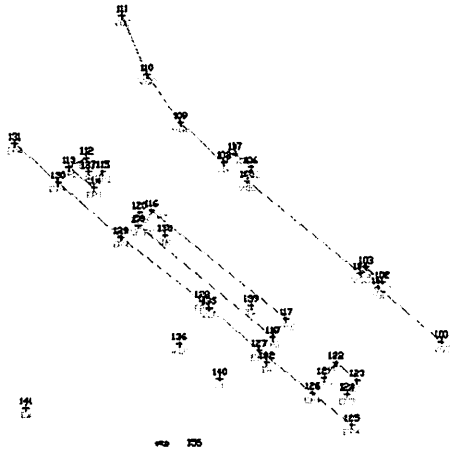
8. From the Points menu: select **Draw 2DLine**

9. Click **<<OK>>**

The command draws a 2-dimensional polyline through all selected points.



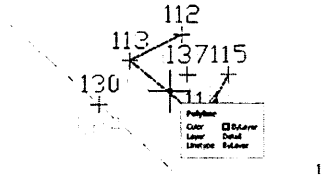
10. In a similar manner, from the *Point Group Manager* dialog box select the descriptions **EP1, EP2, EP3 and EP4,** one group at a time and draw a **2D Line** for each.



Note: You may draw many series of lines from this dialog box but you will not see the actual lines in the drawing until after exit the *Point Group Manager* dialog box

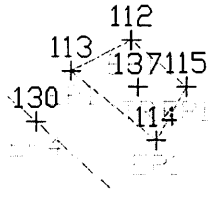
5.2.3 Edit a polyline

1. From the pull-down menu: select **View ⇒ Zoom ⇒ Zoom Point(s).**
2. Zoom to point **137** with a magnification scale of **50.**



Notice the polyline around the EP1 points creates an island that is not closed.

3. Double click on the polyline to edit it
4. At the prompt *Enter an option [Close/Join/Width/Edit vertex/Fit/Spline/Decurve/Ltypegen/Reverse/Undo]:* **C**
5. Enter to end the command.

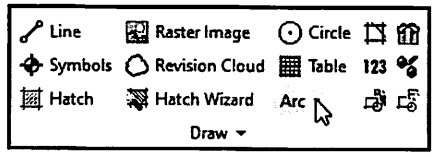


Alternatively, from the pull-down menu:
Select **Edit ⇒ Polyline Utilities ⇒ Close Polylines.**

6. Pan or Zoom to point **121** and close the island polyline around the EP3 points in the same manner as the previous steps.

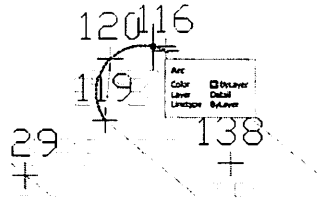
5.2.4 Drawing an Arc

1. Pan over or Zoom to point **120**.
2. Select **Ribbon: Draft ⇒ Draw ⇒ Arc ⇒ 3 Point.**



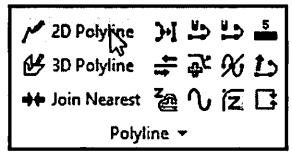
Alternatively from the pull-down menu: select **Draw ⇒ Arc ⇒ 3 Point.**

3. At the prompt *Pick PC point or point numbers:* **119**
4. *Pick Second point or point number:* **120**
5. *Pick PT point or point number:* **116**



5.2.5 Draw a 2D Polyline from points

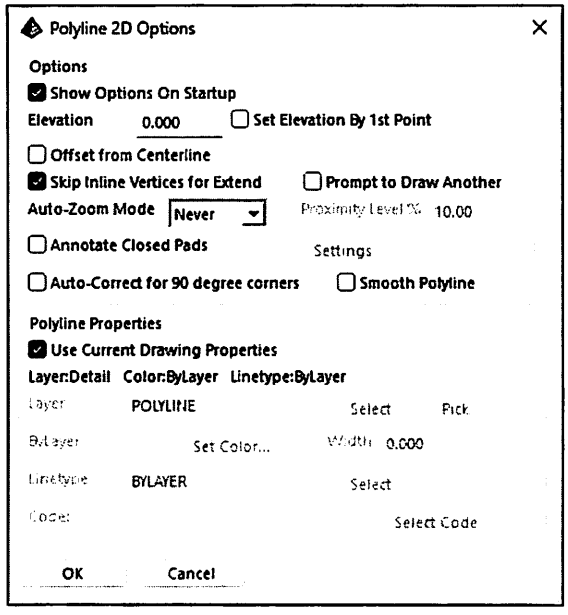
1. Pan over or Zoom to point **132**.
2. Select **Ribbon: Draft ⇒ Polyline ⇒ 2D Polyline**



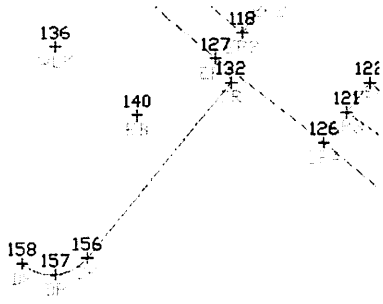
Alternatively, from the pull-down menu: Select **Draw ⇒ 2D Polyline**

This opens the *Polyline 2D Options* dialog box.

3. Confirm **Elevation** is set to **0.**
4. **Enable** the **Use Current Drawing Properties** option. (Alternatively a specific layer name could be entered at this point.)
5. Click **<<OK>>.**



6. At the prompt *[Continue/Extend/Follow/Options/<Pick point or point numbers>]:* enter the first point number of the polyline **132**



7. *[Arc/Close/Distance/Follow/Undo/<Pick point or point numbers>]:* enter the second point **156**

8. *[Arc/Close/Distance/Extend/Follow/Line/Undo/<Pick point or point numbers>]:* enter **A** to draw an arc

9. *[Radius pt/radius Length/Arc length/Chord/Second pt/Undo/<Endpoint or point number>]:* enter **S** for second point on the arc.

10. Second point or point number: **157**

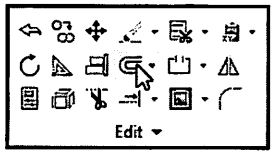
11. Endpoint or point number: **158**

12. Press **Enter** to exit the command.

5.2.6 Offset a Polyline

The previous command drew one side of a driveway through points in the CRD file. Field notes indicate that the driveway is 14 feet wide. This exercise will utilize the offset command to create the other side of the driveway.

1. Select **Ribbon: Draft ⇒ Edit ⇒ Offset**

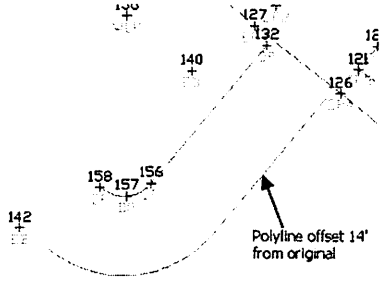


Alternatively, from the pull-down menu: Select **Edit ⇒ Offset ⇒Standard Offset**

2. At the prompt *Specify offset distance or [Through/Erase/Layer]*: enter **14** for the width of the driveway

3. *Select object to offset or [Exit/Undo]:* **Select the polyline** drawn in the previous exercise.

4. *Specify point on side to offset or [Exit/Multiple/Undo]* **Pick** a point anywhere to the right of the first polyline.

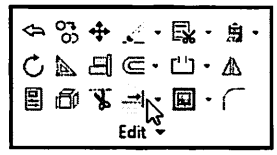


5. **Enter** to exit the command.

5.2.7 Extending and Trimming Entities

The driveway lines just drawn do not intersect the main pavement line. This exercise will demonstrate the Extend command.

1. From the pull-down menu: select **View ⇒ Zoom Point(s).**
2. Zoom to point **132** with a magnification scale of **50**.
3. Notice that the driveway lines drawn in the previous exercises do not intersect the pavement line.
4. Select **Ribbon: Draft ⇒ Edit ⇒ Extend to Edge**

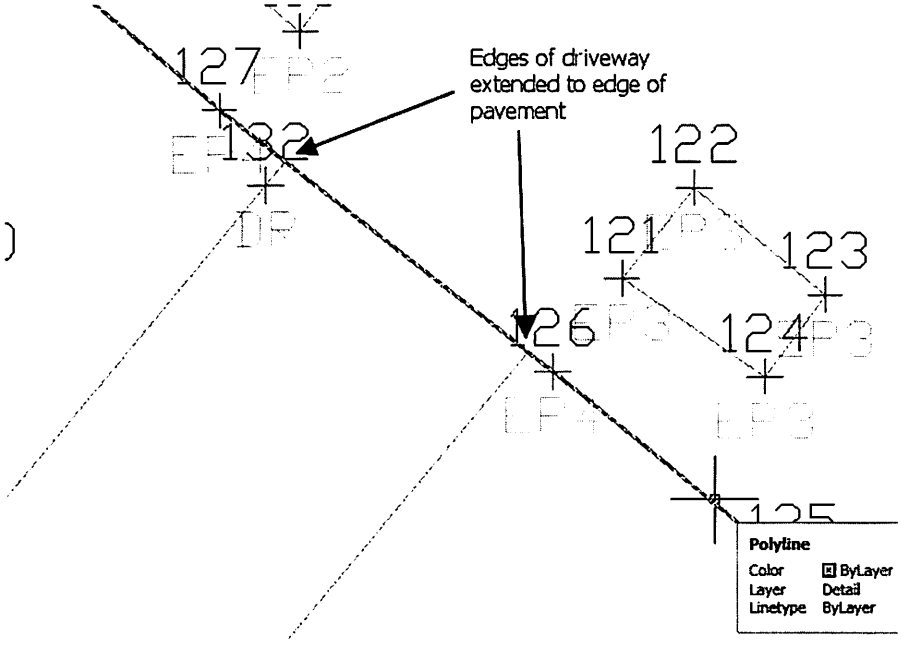


Alternatively, from the pull-down menu:
Select **Edit ⇒ Extend ⇒ To Edge**

5. **In IntelliCAD,**:at the prompt *Select boundary edges ...Select objects or <select all>:* **Select the edge of pavement line.** (the line to extend to..) If you are running Carlson on AutoCAD 2023 the boundary edges are automatically selected for you and you can skip to *Step 7.*
6. Press **Enter** to complete edge selection.
7. *Select object to extend or shift-select to trim or [Fence/Crossing/Project/Edge/Undo]:* **select the 2 driveway polylines.**

Note: Lines, polylines or arcs can be selected individually or by using a crossing or fence to select multiple objects.

The Trim command works identically to the extend command and can be toggled during the command with the shift button on the keyboard.

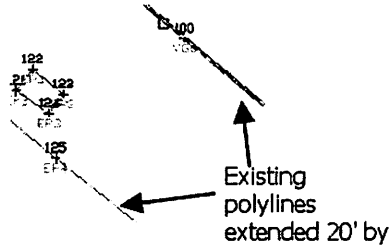


8. **Enter** to exit the command.

5.2.8 Lengthen a Line

In many cases, it is desired to modify an existing entity in place. This exercise will demonstrate the Lengthen command to extend an existing polyline.

1. From the pull-down menu: select **View ⇒ Zoom ⇒ Zoom Point(s).**
2. Zoom to point **125** with a magnification scale of **75**.
3. From the pull-down menu:
   Select **Edit ⇒ Extend ⇒ Lengthen.**
4. At the prompt *Select an object or [DElta/Percent/Total/DYnamic]:* **DE** to enter the desired distance to lengthen the entity.



If you are using *IntelliCAD* type **I** for *Increment* instead of DE.

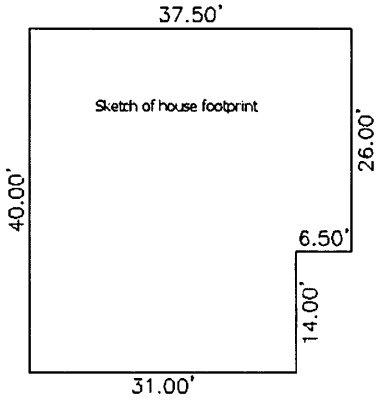
5. Enter delta length or [Angle] <50.00>: **20**
6. Select the 2 polylines ending at points 100 and 125.

Note: The Lengthen command works on 2D polylines, lines and arcs. The options available allow you to enter the distance to extend in a variety of ways.

7. **Enter** to exit the command.

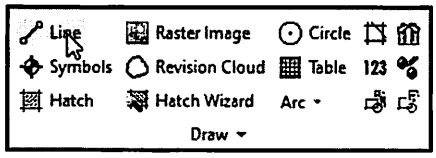
5.2.9 Drawing Lines by Angle and Distance

It is often necessary to drawn lines based on field sketches or plans by others such as an architect. The following steps take you through the process of drawing the footprint of a house based on dimensions measured in the field.



1. **Zoom** to the area of the field located house corner points 140-142.

2. Select **Ribbon: Draft ⇒ Draw ⇒ Line.**

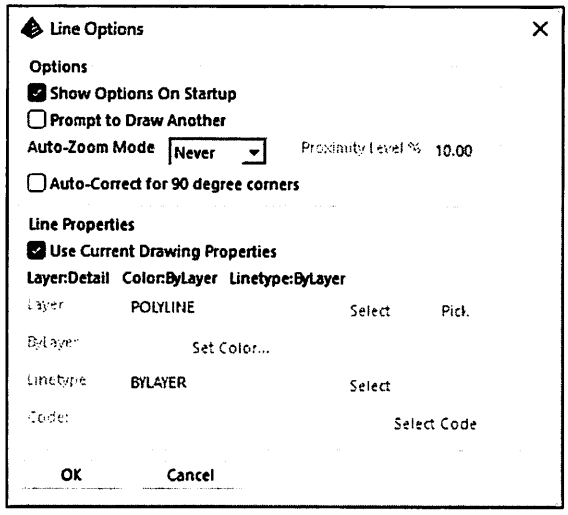


Alternatively, from the pull-down menu:
Select **Draw ⇒ Line ⇒ 2D Line.**

3. This opens the *Line Options* dialog box

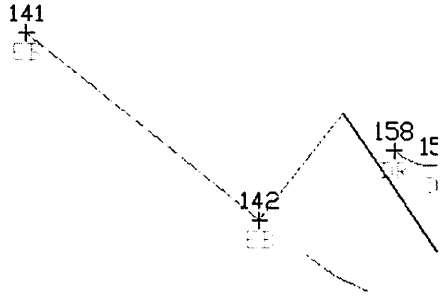
4. Confirm the **Use Current Drawing Properties** option is **Enabled.**

5. Click **<<OK>>.**



6. At the prompt *Options/<Pick point or point numbers>]:* **141**

7. *[Distance/Undo/<Pick point or point numbers>]:* **142**



The command draws a line between points 141 and 142. The next segment of the house is 14' at a right angle to the line just drawn.

8. At the *prompt [Distance/Extend/Undo/<Pick point or point numbers>]:* **D**

9. *Enter Distance [Meters/<Feet>/Chains/Links/Rods/Pick/Quit]:* **14**

10. *Define direction method [Cursor/Line/<Angle>]?* **A**

11. *Enter angle code (1-9) <7>:* **7**

12. *Enter angle (dd.mmss):* **90**

The command draws a 14' line at a 90 degree angle to the first line. Continue following the prompts to draw all dimensions of the house

13. *Enter Distance [Meters/<Feet>/Chains/Links/Rods/Pick/Quit]:* **6.5**

14. *Define direction method [Cursor/Line/<Angle>]?* **A**

15. *Enter angle code (1-9) <7>:* **7**

16. *Enter angle (dd.mmss):* **-90** (can also be entered as 270)

17. *Enter Distance [Meters/<Feet>/Chains/Links/Rods/Pick/Quit]:* **26**

18. *Define direction method [Cursor/Line/<Angle>]?* **A**

19. *Enter angle code (1-9) <7>:* **7**

20. *Enter angle (dd.mmss):* **90**

21. *Enter Distance [Meters/<Feet>/Chains/Links/Rods/Pick/Quit]:* **37.5**

22. *Define direction method [Cursor/Line/<Angle>]?* **A**

23. *Enter angle code (1-9) <7>:* **7**

24. *Enter angle (dd.mmss):* **90**

25. *Enter Distance [Meters/<Feet>/Chains/Links/Rods/Pick/Quit]:* **40**

26. *Define direction method [Cursor/Line/<Angle>]?* **A**

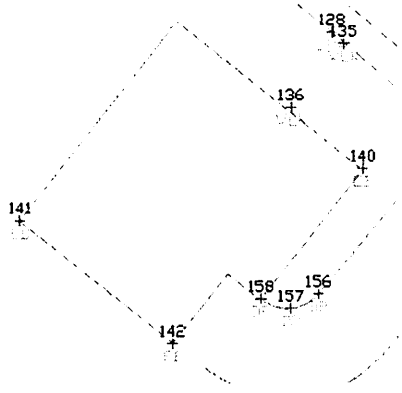
27. *Enter angle code (1-9) <7>:* **7**

28. *Enter angle (dd.mmss):* **90**

29. Enter Distance [Meters/<Feet>/Chains/Links/Rods/Pick/Quit]: **Q**

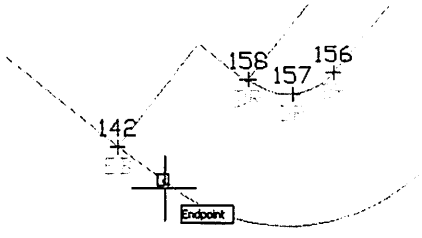
30. *[Distance/Extend/Undo/<Pick point or point numbers>]:* **ENTER** to complete the command

The command draws the complete house footprint.



31. In a similar manner, **Draw a Line** from the house corner at point 142 to the endpoint of the driveway arc.

Note: by holding the shift button on the key board and right click on the mouse, the object Snap selection box is displayed.

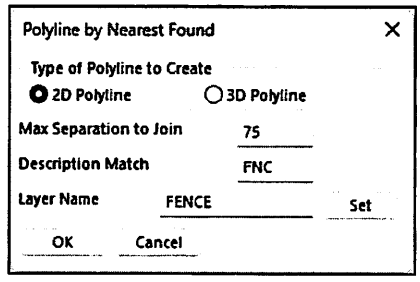


5.2.10 Draw Polyline by Nearest Found

Sometimes points are collected in a way that precludes the ability to connect them in a sequential manner as demonstrated previously. Along with the multitude of polyline utilities contained in Carlson Software, Draw polyline by Nearest Found is one of the more useful. It allows you to connect points in order of their nearest horizontally located point while allowing you to filter by the point description. This exercise will demonstrate that process.

1. From the pull-down menu: Select **Draw ⇒ Polyline ⇒ Polyline by Nearest Found**

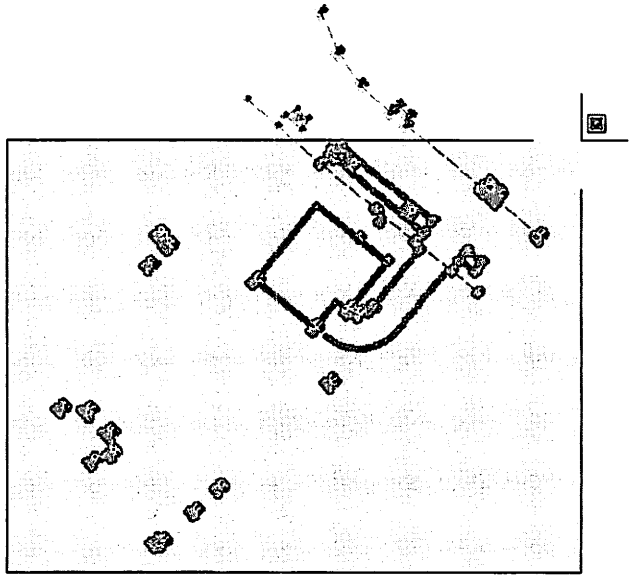
This opens the *Polyline by Nearest Found* dialog box



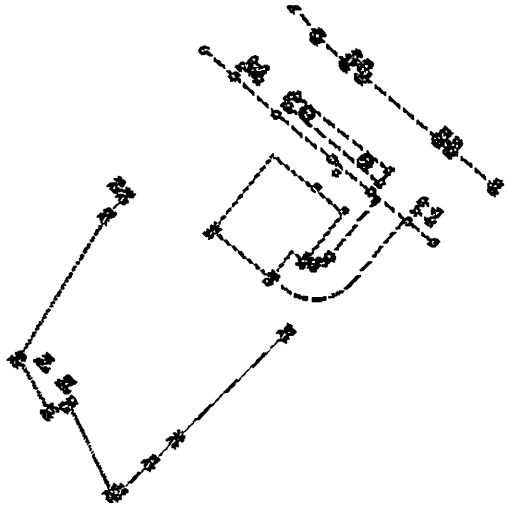
2. For the **Type of Polyline to Create**, select **2D Polyline.**
3. Set the **Max Separation to Join** to **75.**

This controls the maximum distance between points that will be connected by the polyline.

4. For the **Description Match**, enter **FNC.**
5. For the **Layer Name** enter **FENCE.**
6. Click **<<OK>>.**
7. *Select point from screen or by point number* [<Screen>/Number]? Type **S**



8. At the prompt, pick the lower left and upper right corners of the area where the fence points reside.
9. Press **Enter** to stop the selection process.



The program draws a continuous polyline through only the points with the description FNC.

5.2.11 Adding Symbols

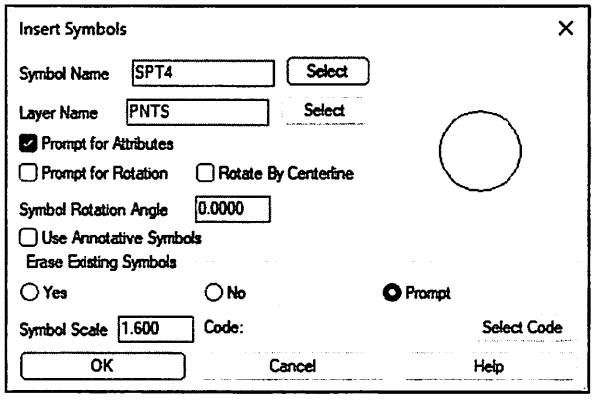
Symbols are routinely used in all types of drawings. Often associated with a legend, symbols add to a clean drawing and eliminate the need for lengthy text explaining each. This exercise will demonstrate drawing symbols from existing libraries. In the chapter **More Essential Tools**, you will a more detailed explanation of the symbol library and how to utilize it.

1. Select **Ribbon: Draft ⇒ Draw ⇒ Symbols.**

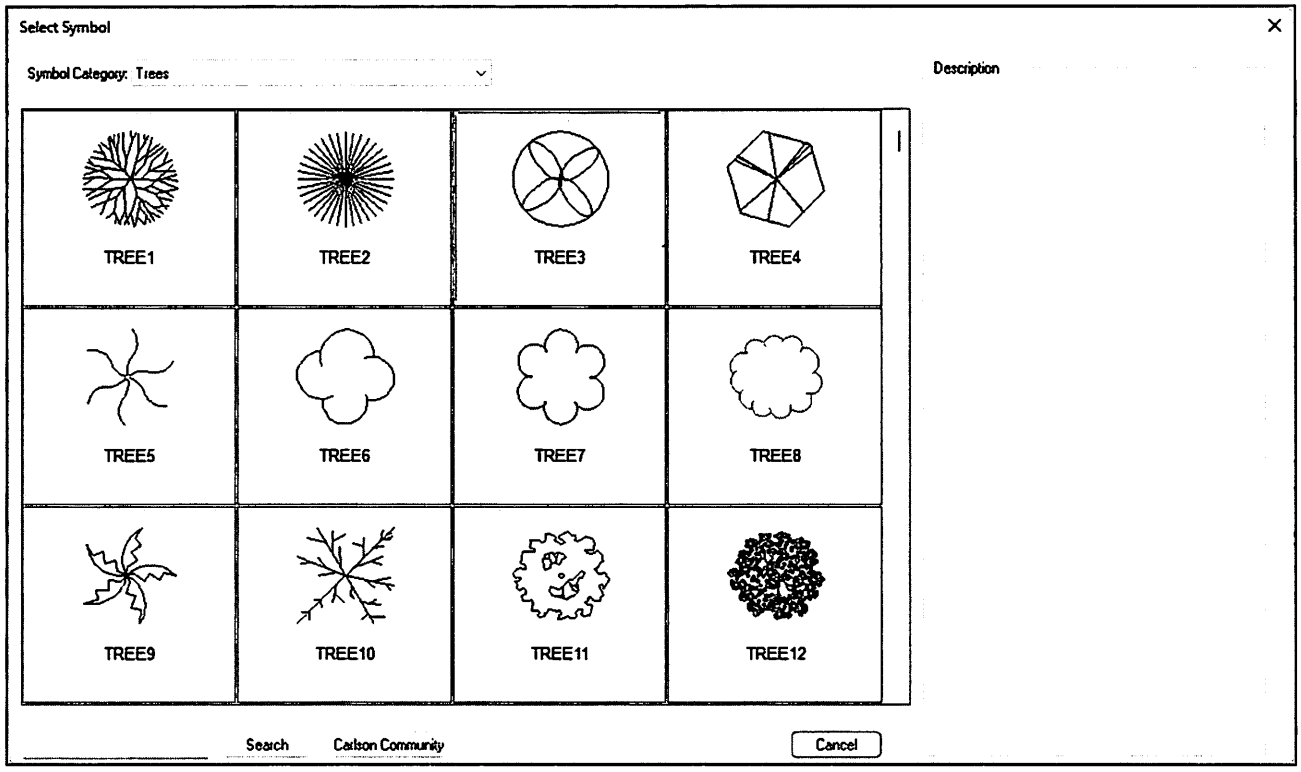
Alternatively, from the pull-down menu:
Select **Draw ⇒Symbols ⇒ Insert Symbols**

This opens the *Insert Symbols* dialog box.

2. Click **<<Select>>** to select a symbol.

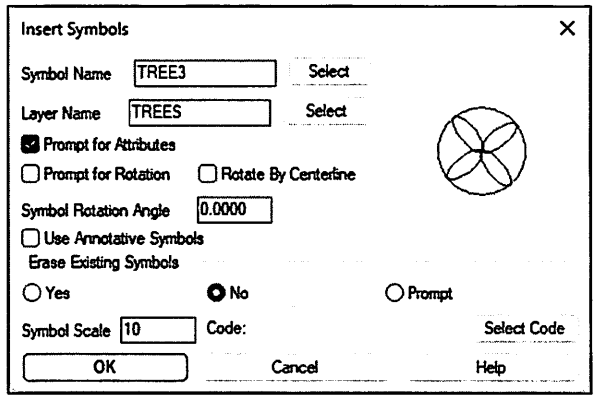


This opens the *Select Symbol* dialog box.

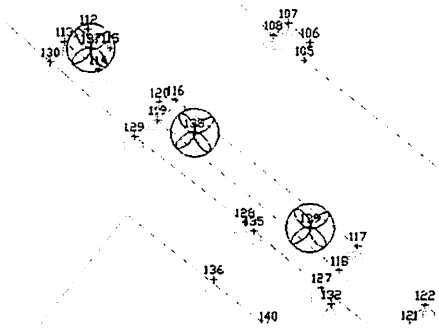


Scrolling through the drop-down list allows you to select the library containing various symbols in each.

3. Select the Symbol Category **Trees.**
4. Select the Symbol **Tree3.**
5. Back in the *Insert Symbols* dialog box set the **Layer Name** to **TREES.**
6. Set the **Erase Existing Symbols** option to **No.**
7. Set the **Symbol Scale** to **10.**
8. Click **<<OK>>.**



9. At the prompt *Options/Select entities/Enter coords/<Pick point or point numbers>:* Enter point range **137-139.**
10. At the prompt Wildcard match of point description <*>: press **Enter.**
11. **Enter** to exit the command.

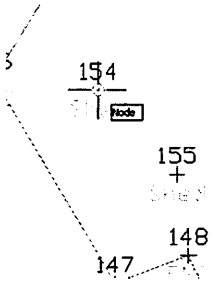


5.2.12 Drawing a Rectangle

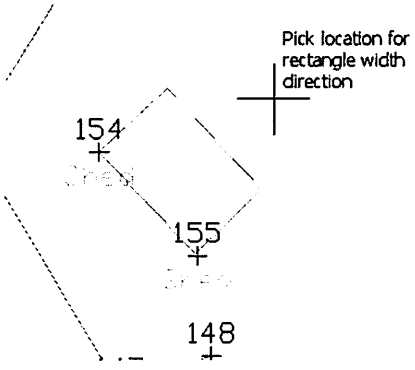
1. Zoom to points **154-155.**
2. From the pull-down menu: Select **Settings ⇒ Point Object Snap On/Off.**

The command line should display: **Point Object Snap ON**

3. From the pull-down menu: Select **Draw ⇒ Rectangle.**
4. At the prompt *Specify first corner point or [Chamfer/Elevation/Fillet/Thickness/Width]:* Snap to point number **154.**



5. At the prompt **Specify other corner point or [Area/Dimensions/Rotation]: R** to set the rotation angle of the rectangle.
6. *Specify rotation angle or [Pick points] <>:* Snap to **Point 155.**
7. *Specify other corner point or [Area/Dimensions/Rotation]:* **D** to enter the dimensions of the rectangle.
8. *Specify length for rectangles <>:* **12** for the length.
9. *Specify width for rectangles <>:* **8** for the width.



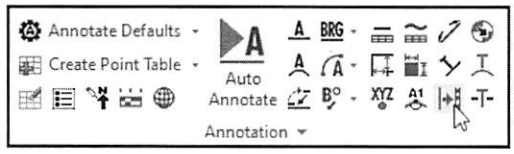
10. At the prompt *Specify other corner point or [Area/Dimensions/Rotation]:* **Pick a Point** to the north of points **154-155.**
11. From the pull-down menu: Select **Settings ⇒ Point Object Snap On/Off.**

The command line should display: **Point Object Snap OFF**

5.2.13 Drawing Special Line Types

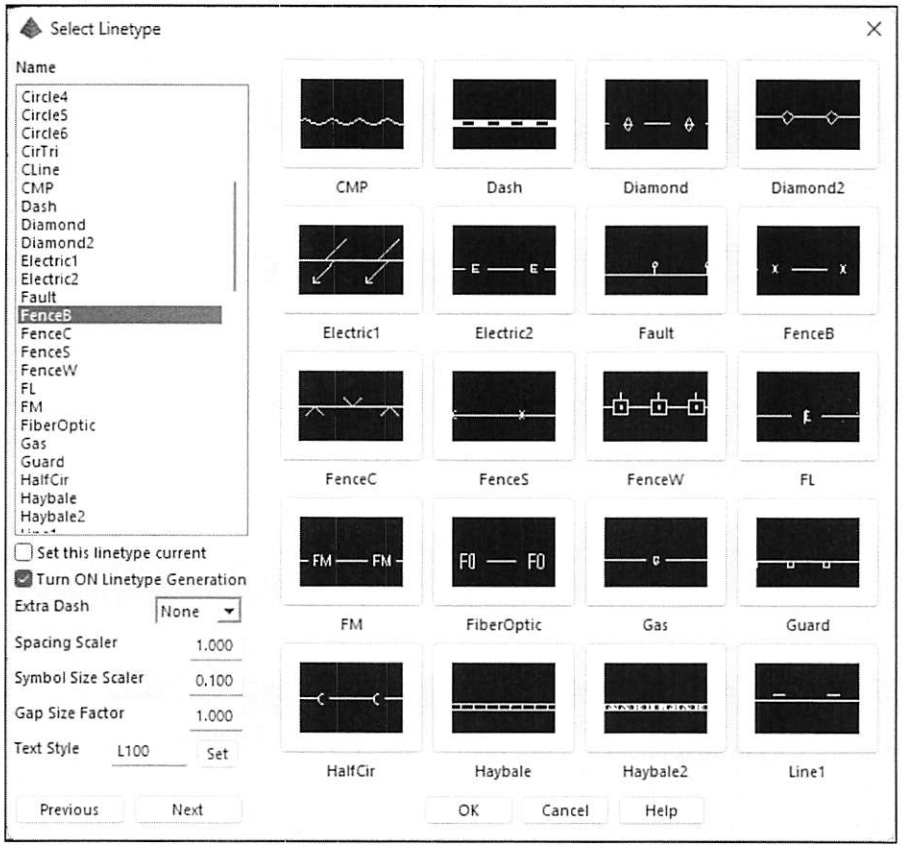
In most instances, line types are needed to depict existing features such as fences and stonewalls. In this exercise you will utilize the **Change Polyline Linetype** to draw a fence line.

1. Select **Ribbon: Annotation ⇒ Annotation ⇒ Change Polyline Linetype.**



Alternatively, from the pull-down menu:
Select **Annotate ⇒ Line Types ⇒ Change Polyline Linetype**

This opens the *Choose LineType* dialog box.



2. Scroll through the line type *Name* list and select the **FenceB** line type.

Note: If you click on the linetype graphic it will close the dialog box before you get a chance to edit any of the other settings.

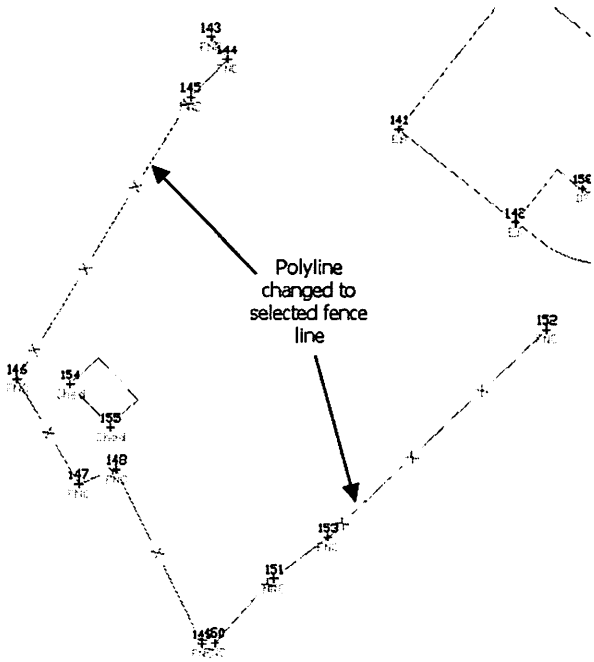
3. Confirm the **Spacing Scaler** is set to **1.00.**
4. Confirm the **Symbols Size Scaler** is set to **0.10.**
5. Confirm the **Gap Size Scaler** is set to **1.00.**
6. Click **<<OK>>.**

7. At the prompt Select linework to change. **Select the Polyline** drawn between the points described as FNC.

8. **Enter** to end the command and change the linetype of that polyline.

The command changes the polyline to one resembling a fence line.

Note: This command changes the polyline into a specific line type so it no longer carries the property of being ByLayer.

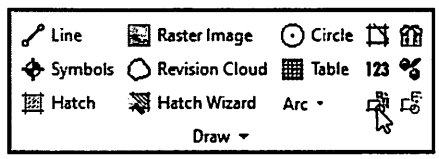


5.2.14 Inserting an External DWG File (with AutoCAD)

The following exercise will take you through the process of inserting a drawing using Carlson with AutoCAD. If you are using IntelliCAD skip to the next exercise.

It is possible for a drawing file to contain blocks within it. These blocks can be created within a drawing file or be external files (DWG files) that are inserted into the current drawing file. In this exercise you will insert an external DWG file containing lot line and fence information.

1. Select **Ribbon: Draft ⇒ Draw ⇒ Insert.**

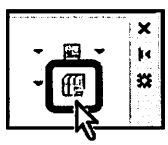


Alternatively, from the pull-down menu: Select **Draw ⇒ Insert.**

2. This opens the *Blocks* palette.

3. Select the **Libraries** tab of the **Blocks** palette.

4. Select the **Browse Block Libraries** button to load a drawing into the **Blocks Palette**.



The **Select a folder or file for Block Library** dialog box appears.

5. Browse and select **Carlson Projects\APG 2023 Data\Basic CAD Drawing**

Do not select a file here, just the folder that contains the *Lot Lines* drawing.

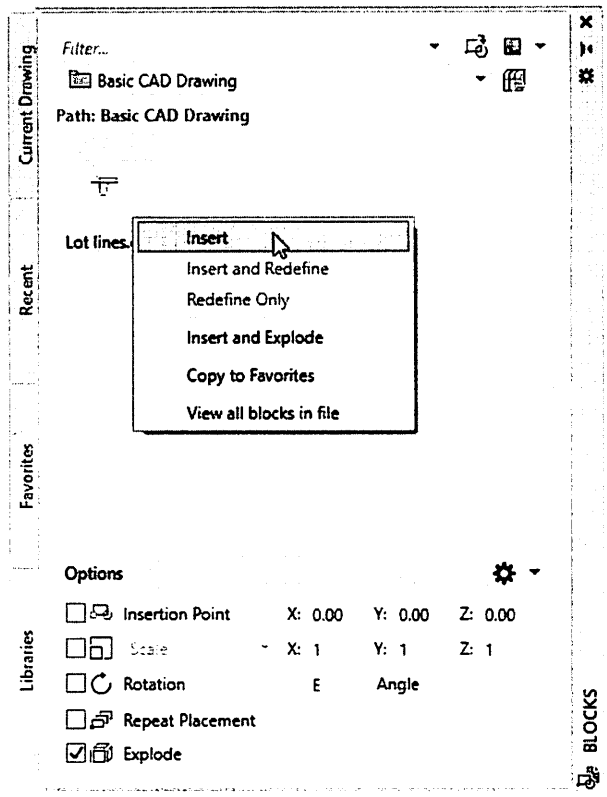
6. Click **<<Open>>**.

The drawing appears in the **Blocks** palette.

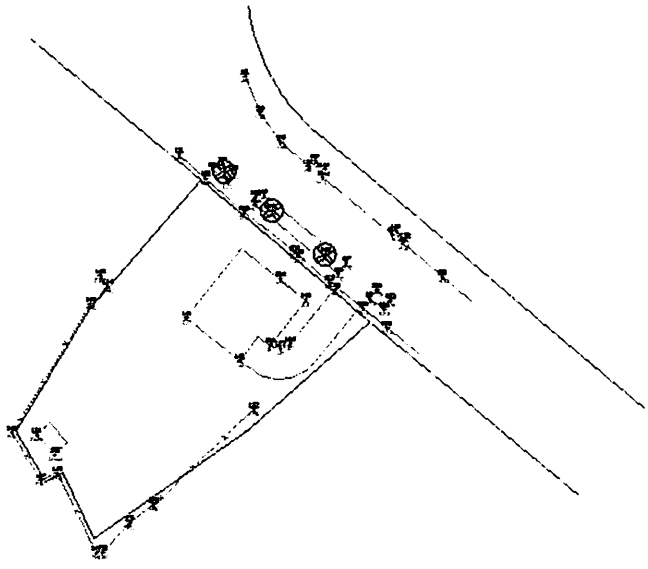
7. Disable the option for **Insertion Point** and confirm it is set to 0,0,0.

8. Enable the option to **Explode** the block.

9. Right-click on the drawing Lot Lines and select **Insert**.



The command inserts all geometry from the external file into the current drawing file.



5.2.15 Inserting an External DWG File (with IntelliCAD)

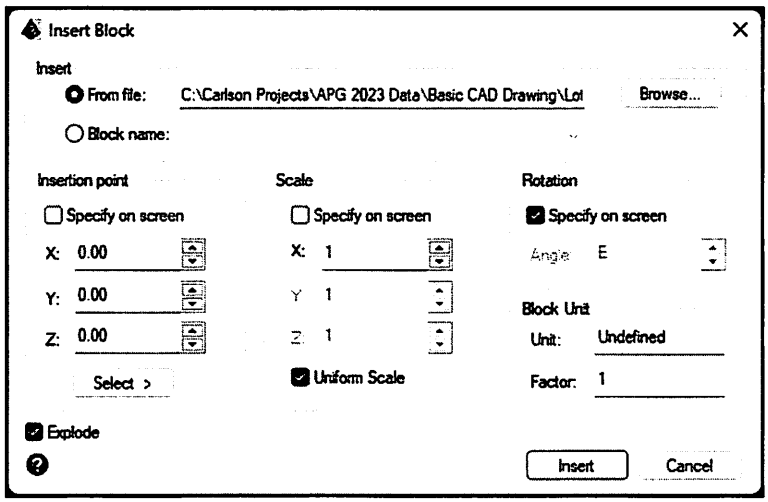
The following exercise will take you through the process of inserting a drawing using Carlson with IntelliCAD.

It is possible for a drawing file to contain blocks within it. These blocks can be created within a drawing file or be external files (DWG files) that are inserted into the current drawing file. In this exercise you will insert an external DWG file containing lot line and fence information.

1. Select **Ribbon: Draft ⇒ Draw ⇒ Insert.**

Alternatively, from the pull-down menu: Select **Draw ⇒ Insert.**

This opens the *Insert Block* dialog box.

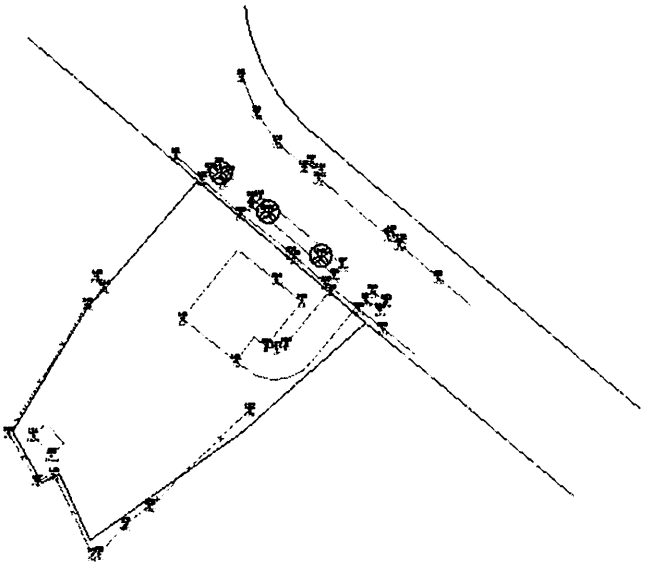


2. Click **<<Browse>>** to select an external drawing.
3. Browse and select **Carlson Projects\APG 2023 Data\Basic CAD Drawing\Lot Lines.DWG**
4. Back in the *Insert Block* dialog box, confirm the **Insertion Point Specify On-screen** option is **Disabled.**
5. Confirm the **Scale Specify On-screen** option is **Disabled and the X Scale is set to 1.**
6. Confirm the **Rotation Specify On-screen** option is **Disabled.**
7. **Enable** the **Explode** option.

This will insert the lot lines drawing file ensuring the same coordinate base, rotation and scale as the source drawing. This of course is drawing/project dependent.

8. Click **<<Insert>>.**

The command inserts all geometry from the external file into the current drawing file.



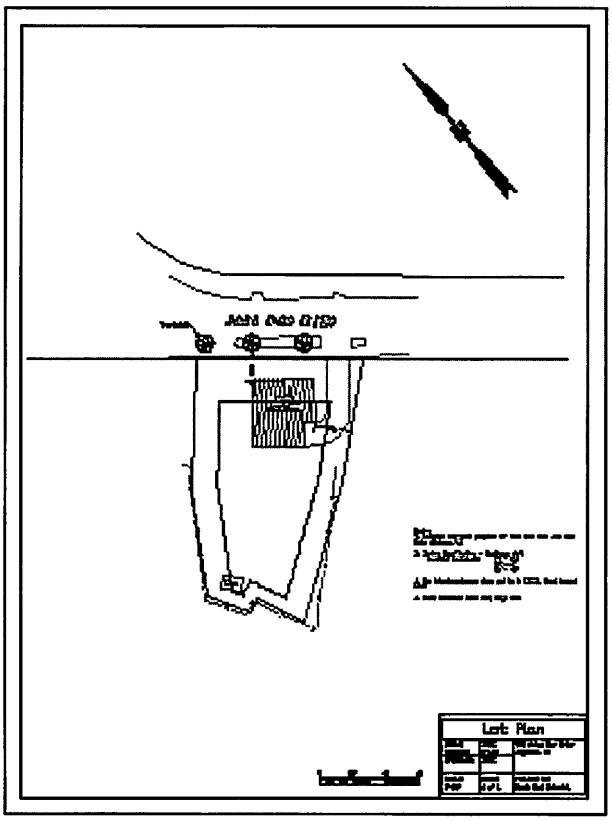
Lesson Review

In this lesson you were exposed to many drawing and editing commands for creating geometric objects associated with point data from a CRD file. This is only a beginning. Take the time to explore all of the drawing and editing commands to become more efficient in creating a complete plan.

5.3 Lesson: Drawing Presentation and Creating a Final Plan

Introduction

Carlson has many tools available for the surveyors, engineers and other design professionals to assist and automate the process of getting data into a project. Sometimes finalizing a plan, getting it the "way you want", takes as long as entering the data to start with. Carlson contains many tools for the process of drawing and completing a plan that will not only save you time, but assist in standardizing your projects as well. Things like text, title blocks, notes, and north arrows are an example of such standards. In this lesson you will become familiar with some of the drawing commands for making plan enhancements and options for setting up many drafting standards.



Key Concepts

Concepts and key terms covered in this lesson are:

- Setting a drawing orientation
- Adding text dimensions and leaders
- Drawing borders and title blocks

Objectives

After completing this lesson, you will be able to:

- Use a variety of tools to draw objects to enhance your drawing
- Understand how to set standards to ensure consistency in drawing creation

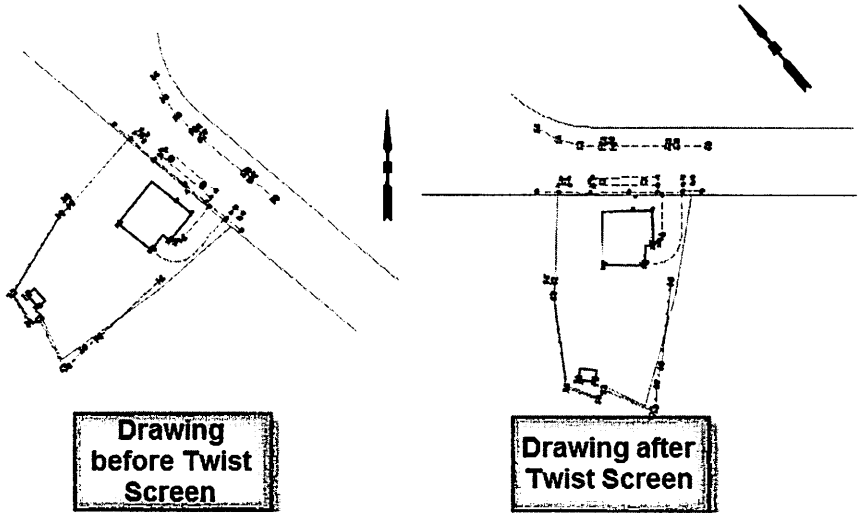
Standardizing the Appearance of Drawings

Much like previous chapters and lessons, in this lesson you will hear the term "Standards" a lot. For those new to CAD this may seem somewhat complicated or difficult to implement, but actuality, once you make a few advanced settings it is really quite easy. From the days of hand drafting, companies have implemented standards and those with pen and ink would adhere to those standards ensuring that each plan they drew had a consistent look.

In CAD the same thought process takes place but can be implemented automatically. As you go through the process of creating a plan you need to think about how you want your finished product to look and ensure default setting along the way, reflect that vision. For example, some surveyors insist that all plans have a north rotation up and to the left while others prefer that the right of way line be perpendicular to the page orientation. Other considerations are text size, font, title block, north arrow, plan notes and dimensioning a plan.

Drawing Orientation

The Drawing Orientation refers simply to the direction of the north arrow. Remember that the base point of your drawing needs to always be at coordinates 0,0,0. Setting the north rotation is done using Carlson's' *Twist Screen* command that rotates the appearance of how a plan looks when printed without changing that base point.



Text Styles

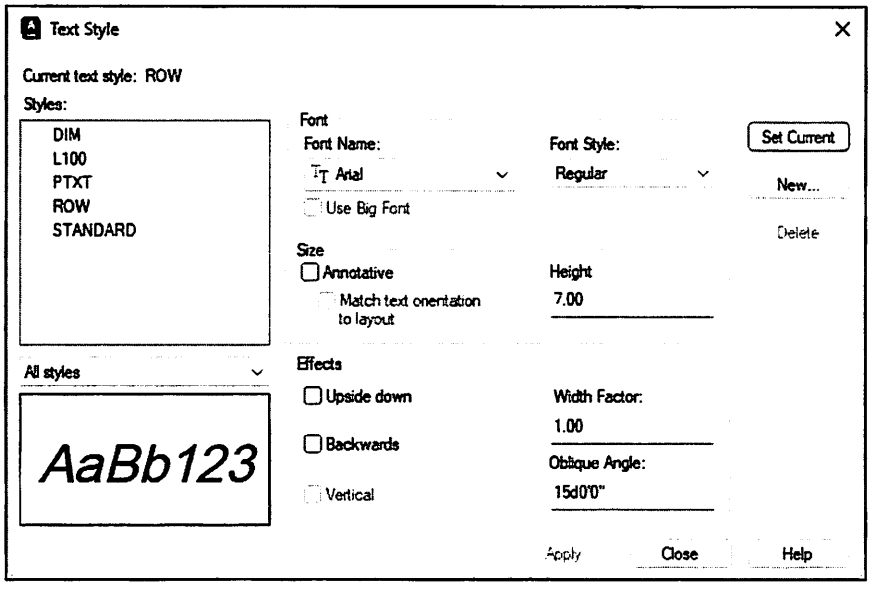
Text is one of the more frustrating learning curves for new CAD users. In CAD, all entities relate to units of measure which are in a sense determined by the user. For example, 1 CAD unit = 1 foot will be different than 1 CAD unit = 1 inch. This is very important in terms of the printed scale, or "plot scale". With this in mind, the size of the text is thought of in those same units and scaled one way or the other to the final printed "plot scale". For example, if you would like the text on your plan to be 0.10 inches in height when you send it to the printer and the scale of your drawing is 1"=20', you would create the text at 2.00' in height.

"Plot scale" x drawing scale = text height.

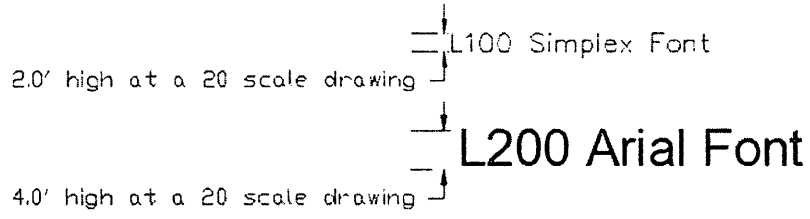
In addition to the height of the text, there are a large variety of fonts available within Carlson.

Simplex
Arial
Times New Roman

The text height, font and many other variables for text can be stored as a **Text Style**.



During the process of placing text in your drawing, you can then simply enter the name of the *Text Style* and be assured it will look correctly when printed.

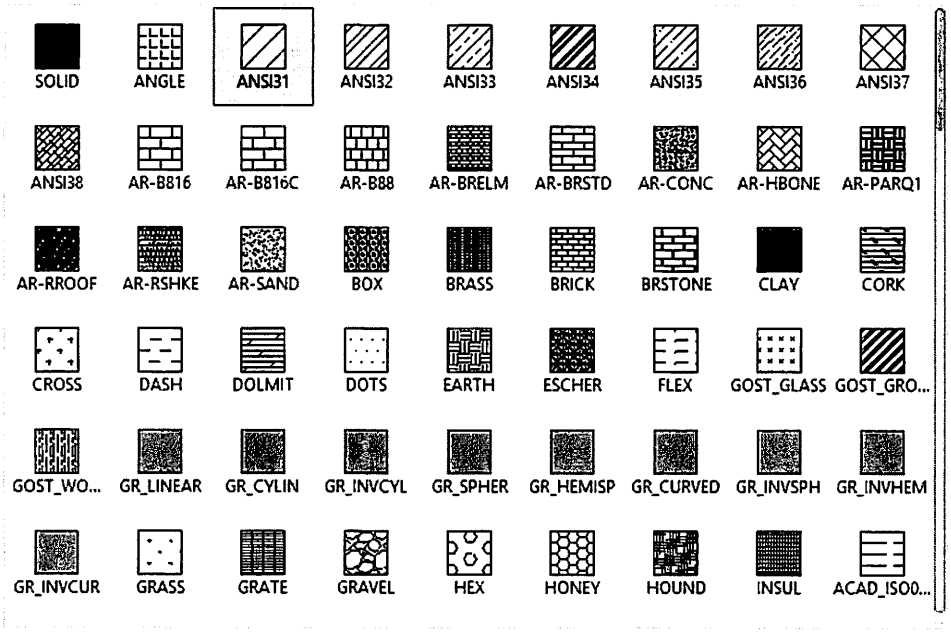


Using *Text Styles* are a very common way to implement standards in drawing output. You can create *Text Styles* and save them in your standard drawing template so they are available in every new drawing.

At the beginning of this chapter you went through the process of using Carlson's Set Text Style in the *Drawing Setup* to create a set of text styles at a variety of sizes with a simplex font. This tool is a quick way to generate a good assortment of text styles to use throughout your plan preparation.

Hatch Patterns

Hatch patterns are commonly used in CAD to enhance the looks of a drawing as well as to highlight certain important features. Carlson contains many preset hatch patterns for your use. Each one is modifiable as to the density, scale, angle, and transparency of the pattern. There is also the ability to create "Gradient" patterns using the same command.



The exercises in this chapter take you through some very basic commands that help add enhancements to your plan. Remember to note as you work through these exercise how you can set up standards to be implemented in all future drawings saving you time and creating a consistent product. The automation part of the process happens when you setup defaults and save them or add elements to your drawing template(s).

Exercises: Modifying the drawing and adding enhancements for final plan preparation
In these exercises you will:

- Set the drawing orientation
- Add text, dimensions and hatch patterns
- Create setback lines
- Manipulate layers
- Add specific plan elements

5.3.1 Drawing Orientation

Most organizations have drawing standards that include the drawing orientation, "the placement of the site on the page". As noted in the beginning of this chapter, Carlson keeps its coordinate base coincidental with the CAD drawing base. However, many times the drawing layout is not acceptable from a cosmetic point of view and a visual rotation is desired.

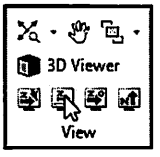
In this exercise you will use the Carlson Twist Screen to reorient the drawing.

IMPORTANT Carlson's *Twist Screen* command alters your view of the drawing but does NOT alter the coordinate base or the coordinates contained in the CRD file. **DO NOT** use a standard CAD Rotation command to change the appearance of the drawing as that will in fact change the coordinates of the project.

1. Open the drawing **C:\Carlson Projects\APG 2023 Lesson 5_3\DWGS\5_3.DWG.**

For this exercise, it is desired that drawing orientation be such that the right of way lines are parallel with the X axis in the drawing.

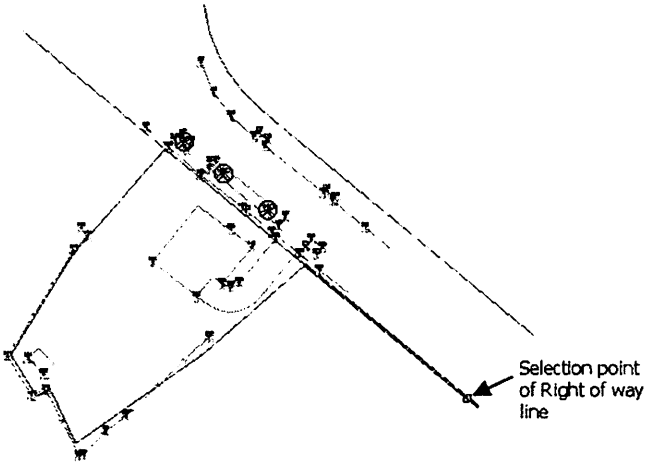
2. Select **Ribbon: Draft ⇒ View ⇒ Line, Polyline or Text.**



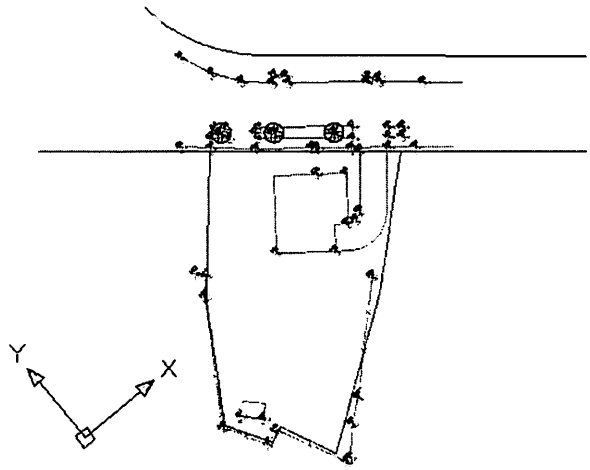
Alternatively, from the pull-down menu:
Select **View ⇒ Twist Screen ⇒ Line, Polyline or Text.**

3. **Select a point** on a right of way line near the right end.

4. At the prompt *Twist azimuth for selected LINE (Use 90 for Due East) <90.0>:* press **ENTER.**



The command reorients the drawing.
Accordingly, north is now angled to the left.



5.3.2 Adding Text

There are basically 2 methods of adding text to your drawing: standard text which enters separate lines of text that can be edited individually and multiline text which allows you to enter text in paragraph form, keeping all lines of text as a single entity. Carlson also has an option to import text from an external file which is advantageous for notes or basic plan information that is similar in multiple drawings.

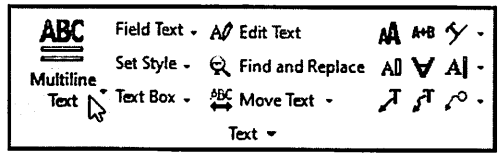
In this exercise you will:

- Use standard and multiline text
- Create a new Text Style
- Import a text file

Multiline Text

1. Zoom to the house location

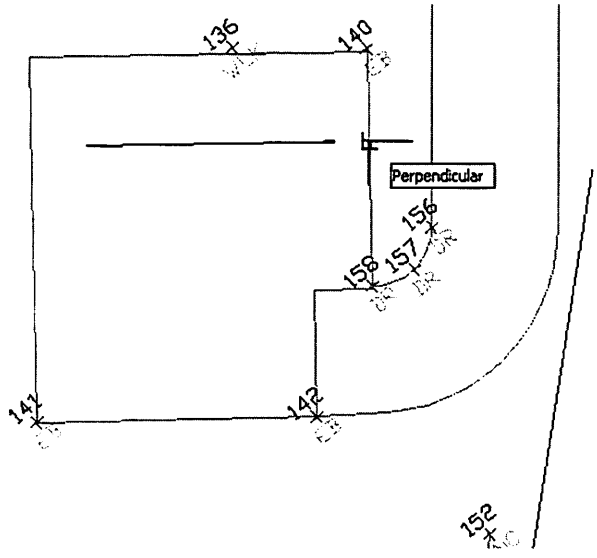
2. Select **Ribbon: ⇒Draft ⇒ Text ⇒ Multiline Text.**



Alternatively, from the pull-down menu:
Select **Draw ⇒ Text ⇒ Multiline Text.**

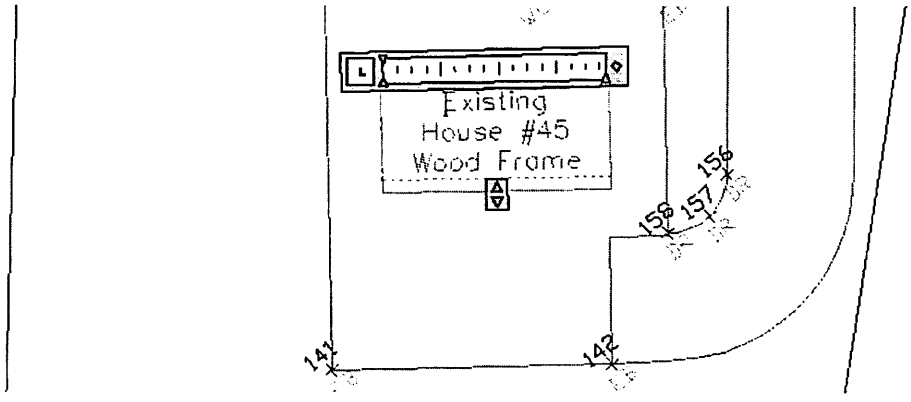
3. At the prompt *Specify first corner:* **Pick a Point** in the upper left corner of the house.

4. *Specify opposite corner or [Height/Justify/Line spacing/Rotation/Style/Width/Columns]:* **R** to set the rotation of the text.



If you are using IntelliCAD you need to pick a point inside the building for the first point and then snap perpendicular to the right side of the building.

5. *Specify rotation angle <E>*: Using the **Perpendicular OSnap, pick a point** on the right side of the house.



6. Specify opposite corner or [Height/Justify/Line spacing/Rotation/Style/Width/Columns]: **Pick a Point** to the lower right of the first point.

This opens a new tab on the Ribbon called *Text Editor*.

7. In the upper left corner, set the Text Style to **L100.**

If you are using IntelliCAD you may be prompted about changing the style. Simply pick *Yes*.

8. Set the **Justification** to **Top Center**.

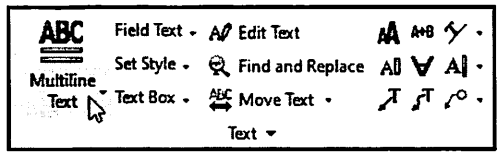
9. Enter the text **Existing House #45 Wood Frame.**

10. Click **<<OK>>** to close the *Toolbar* or **Close Text Editor** to close the *Ribbon Tab*.

Standard Text

11. Zoom to the shed location.

12. Select **Ribbon: Draw ⇒ Text ⇒ Single Line.**



If you are using IntelliCAD *Single Line* text is called *Standard.*

Alternatively, from the pull-down menu:
Select **Draw ⇒ Text ⇒ Standard Text.**

13. At the prompt *Specify start point of text or [Justify/Style]:* **S** to set the text Style.

14. *Enter style name or [?] <Simplex>:* **L100**

15. *Specify start point of text or [Justify/Style]:* **J** to set the text justification.

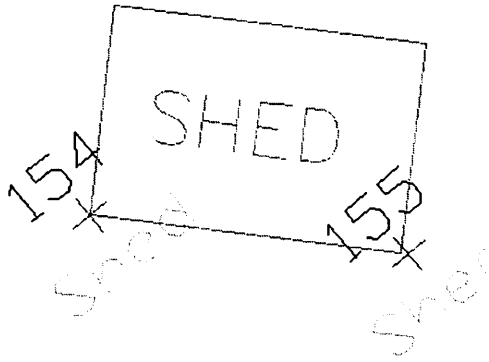
16. *[Align/Fit/Center/Middle/Right/TL/TC/TR/ML/MC/MR/BL/BC/BR]:* **MC**

17. Specify middle point of text: **Pick a Point** in the center of the shed.

18. Specify rotation angle of text <E>: Using the **Perpendicular OSnap, pick a point** on the right side of the shed.

19. Enter the text **SHED.**

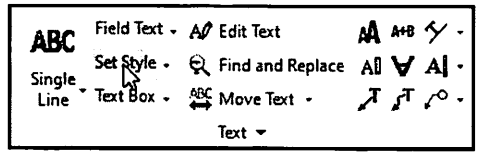
20. **Enter** twice to complete the command.



Create a New Text Style

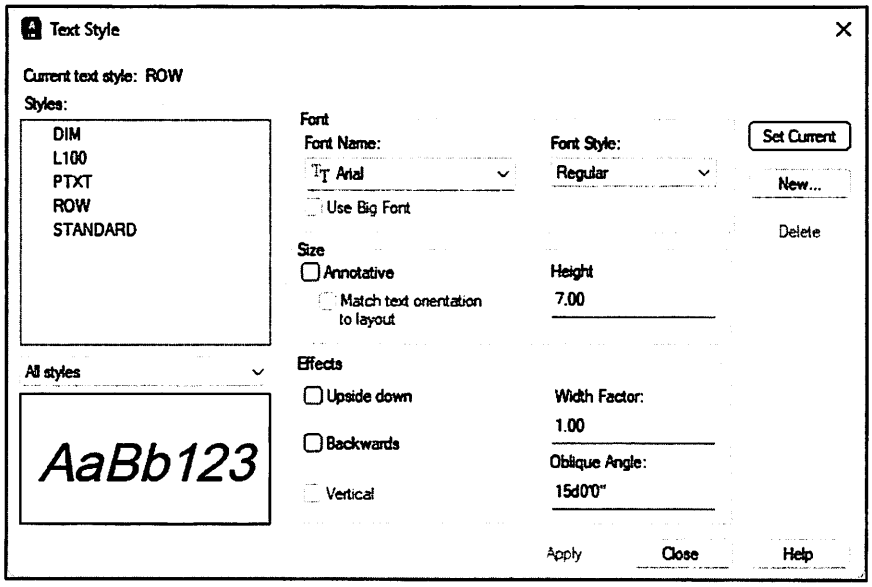
21. Zoom to the Street location.

22. Select **Ribbon: Draft ⇒ Text ⇒ Set Style.**



Alternatively, from the pull-down menu:
Select **Draw ⇒ Text ⇒ Set Style.**

This opens the *Text Style* dialog box.



23. Click **<<New>>.**

24. Name the new style **ROW.**

25. Under the **Font Name**, scroll and select the font **Arial.**

26. Set the **Text Height** to **7.00.**

27. Confirm the **Width Factor** is **1.00.**

28. Set the **Oblique Angle** to **15.**

29. Highlight the new text style **ROW** and click **<<Set Current>>.**

In IntelliCAD there is no *<<Set Current>>* button, instead just make sure the ROW style is selected in the *Current Style Name* list.

30. Click **<<Close>>.**

31. Repeat the steps from the above *Standard Text* example to create **Single Line Text.**

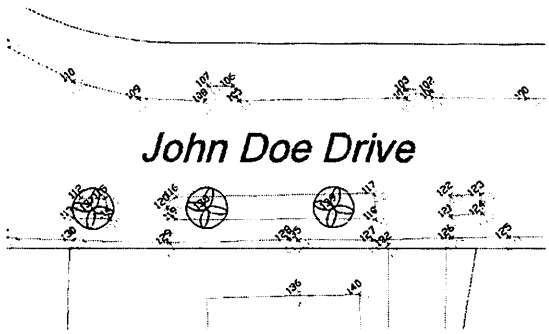
32. At the prompt *Specify start point of text or [Justify/Style]:* **J** for *Justify* then **C** for *Center* Justified

33. *Specify center point of text:* **Pick a Point** in the center of the roadway.

34. *Specify rotation angle of text <>:* **Pick a Point** to the right approximately parallel to the right of way lines.

35. Enter the text **John Doe Drive.**

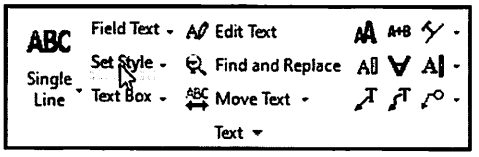
36. **Enter** twice to complete the command.



Import a Text File

The Import Text command imports a file containing simple text created in Note Pad, Word or other such programs. This gives you the ability to create large text files that would be cumbersome entered directly into CAD.

37. Select **Ribbon: ⇒ Draft ⇒ Text ⇒ Set Style.**

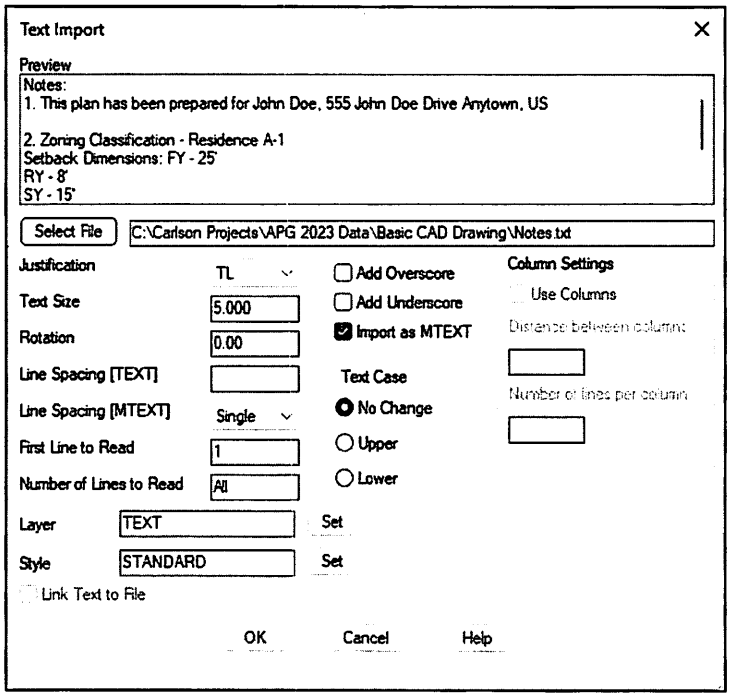


Alternatively, from the pull-down menu:
Select **Draw ⇒ Text ⇒ Set Style.**

38. Set the current Text Style to **L100.**

39. From the pull-down menu: Select **Draw ⇒ Text ⇒ Text Import.**

This opens the *Text Import* dialog box



40. Click **<<Select File>>.**

41. Browse and select the file **C:\Carlson Projects\APG 2023 Data\Basic CAD Drawing\Notes.TXT**

NOTE: You might need to change the file type to ***.txt** at the bottom of the *Select File to Import* dialog box.

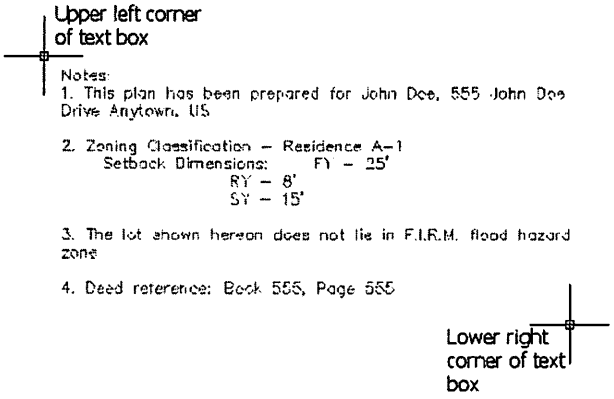
42. Click **<<Open>>.**

The program displays the text contained in the selected file.

43. **Enable** the **Import as MTEXT** option.

44. Click **<<OK>>.**

45. Following the prompts, **Pick a Point** on the screen for the upper left and lower right corner of the text box in a blank area of the drawing where you would like to display the notes.


Upper left corner of text box
Notes:
1. This plan has been prepared for John Doe, 555 John Doe Drive Anytown, US
2. Zoning Classification – Residence A–1
Setback Dimensions: FY – 25'
RY – 8'
SY – 15'
3. The lot shown hereon does not lie in F.I.R.M. flood hazard zone
4. Deed reference: Book 555, Page 555
Lower right corner of text box

The command inserts the imported text into a Multiline Text box that can be edited as in the previous example.

You can change the width of the MText by selecting it and stretching it to the desired size.

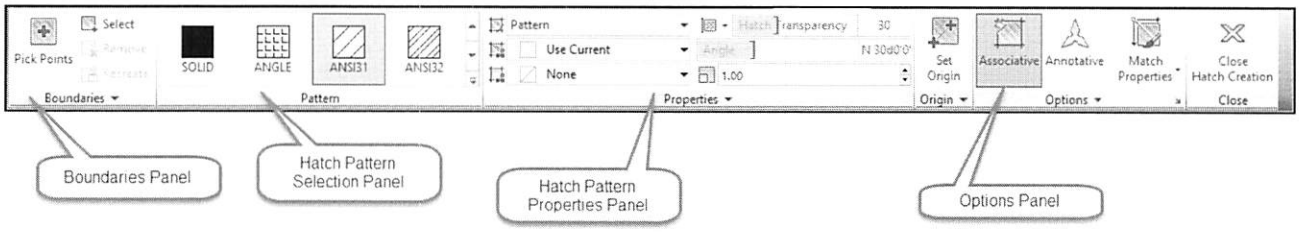
5.3.3 Drawing a Hatch Pattern (with AutoCAD)

The following exercise will take you through the process of drawing a hatch pattern using Carlson with AutoCAD. If you are using IntelliCAD skip to the next exercise.

1. Zoom to the House location.
2. Create a new layer named **EXBLD** and set it current.
3. Select **Ribbon: Draft ⇒ Draw ⇒ Hatch.**

Alternatively, from the pull-down menu:
Select **Draw ⇒ Hatch ⇒ Standard Hatch.**

This opens the *Hatch and Gradient* Ribbon.



The **Boundaries Panel** allows you to select objects to hatch or pick a point on the screen within the area of objects that form a closed figure

The **Hatch Pattern Selection Panel** is where you can scroll through different types of hatch patterns or you may use the drop-down box to see more at a time.

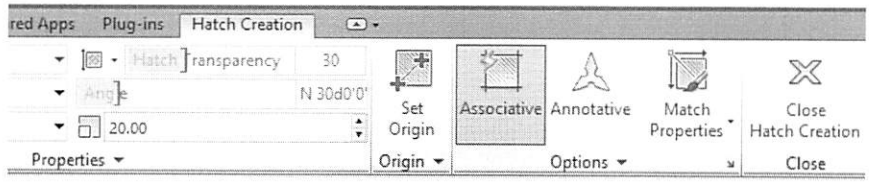
The **Properties Panel** is the location where you can set or change the scale, angle, transparency and other properties of the hatch pattern. If you have already selected objects to hatch, you can modify these properties in real time.

The **Options Panel** contains additional property modifiers such as making the hatch pattern associative (will update along with the selected boundary objects) or annotative (the scale of the hatch pattern changes with the annotative scale of the drawing).

4. At the prompt *Pick internal point or [Select objects/Undo/seTtings]:* **Pick a Point** in within the boundary of the house.

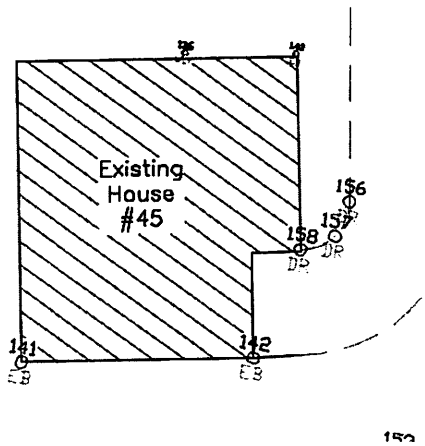
If the ribbon does not appear, skip ahead to step 11.

5. Select **Ansi31** hatch pattern.
6. **Set the Transparency to 30.**
7. **Set the angle to 30.**
8. Set the Scale to **20.**
9. Enable the **Associative** option.



10. Click **<<Close>>.**

The hatch pattern is created and can be modified using the same ribbon panels above.



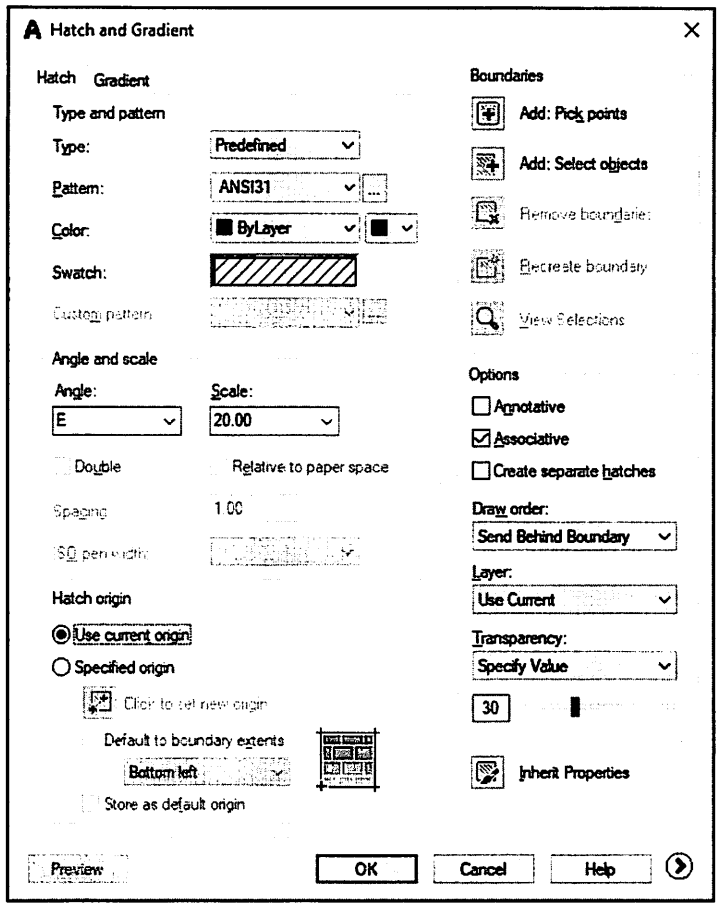
11. If the ribbon did not appear to set the hatch values, enter **T** to open the *Hatch and Gradient* dialog box.

12. Select the **Ansi31** hatch pattern.

13. Set the Scale to **20.**

14. Enable the Option **Associative.**

15. Click **<<OK>>.**



16. At the prompt *Pick internal point or [Select objects/Undo/seTtings]:* **Pick a Point** in within the boundary of the house.

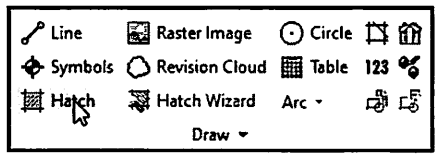
The hatch is now added to the area of the house.

17. Enter to end the command.

5.3.4 Drawing a Hatch Pattern (with IntelliCAD)

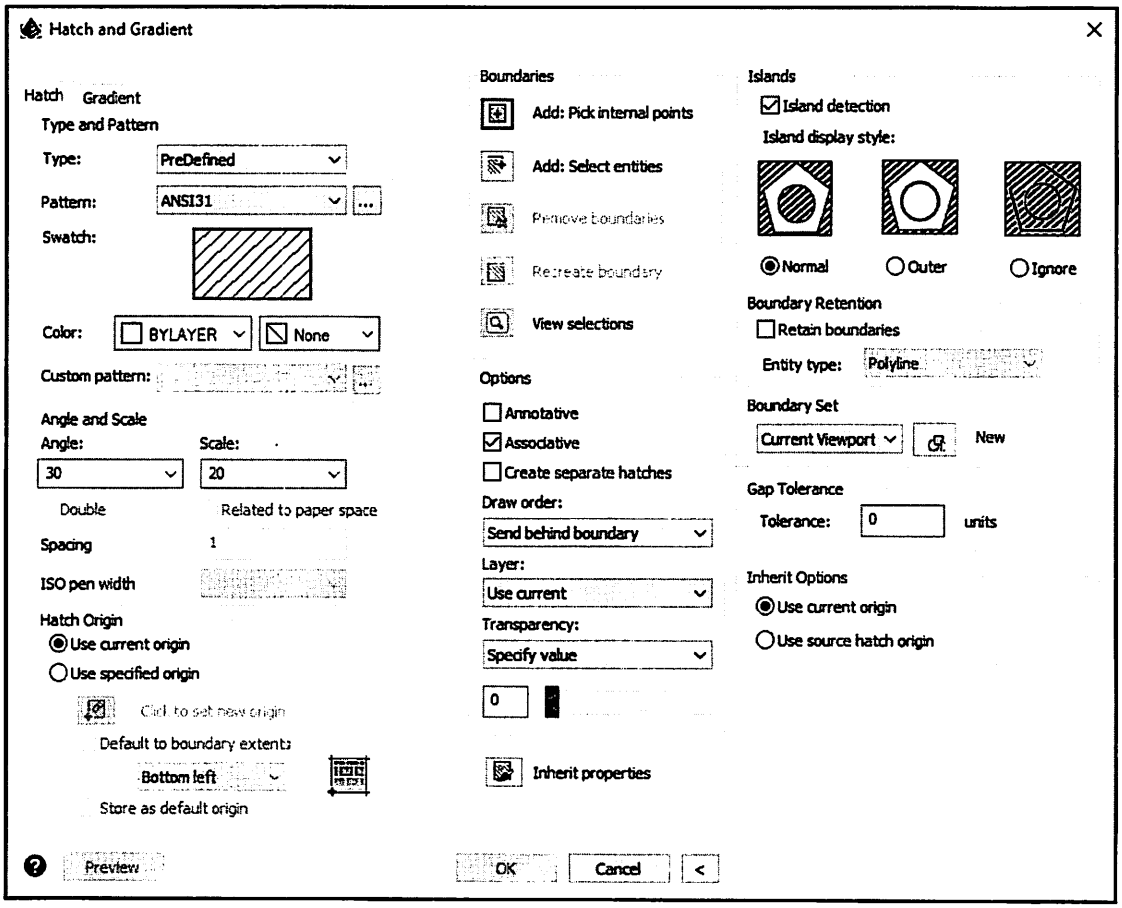
The following exercise will take you through the process of drawing a hatch pattern using Carlson with IntelliCAD.

1. Zoom to the House location.
2. Create a new layer named **EXBLD** and set it current.
3. Select **Ribbon: Draft ⇒ Draw ⇒ Hatch.**



Alternatively, from the pull-down menu:
Select **Draw ⇒ Hatch ⇒ Standard Hatch.**

This opens the *Hatch and Gradient* dialog box.



4. Select the **Ansi31** hatch pattern.
5. Set the **Angle** to **30**.
6. Set the **Scale** to **20.**
7. Enable the **Associative** option.
8. Set the **Island display style** to **Normal.**
9. Click the **Add: Pick Points** button.

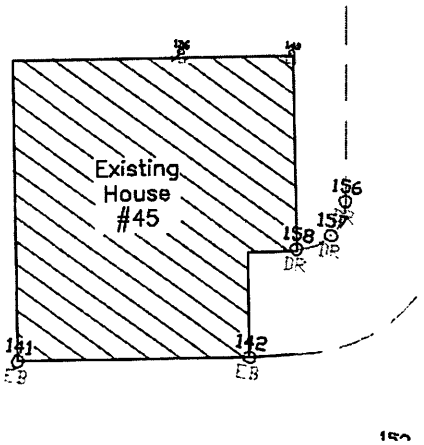
10. **Pick a Point** in within the boundary of the house.

11. You will see a preview of the hatch inside the house. **Enter** to complete the selection and return to the *Hatch and Gradient* dialog box.

12. Click **<<OK>>.**

The hatch pattern is created.

Note: You can modify the scale, rotation and hatch pattern by double clicking the hatch pattern and returning to the Boundary Hatch dialog box.



5.3.5 Drawing Variable Offsets

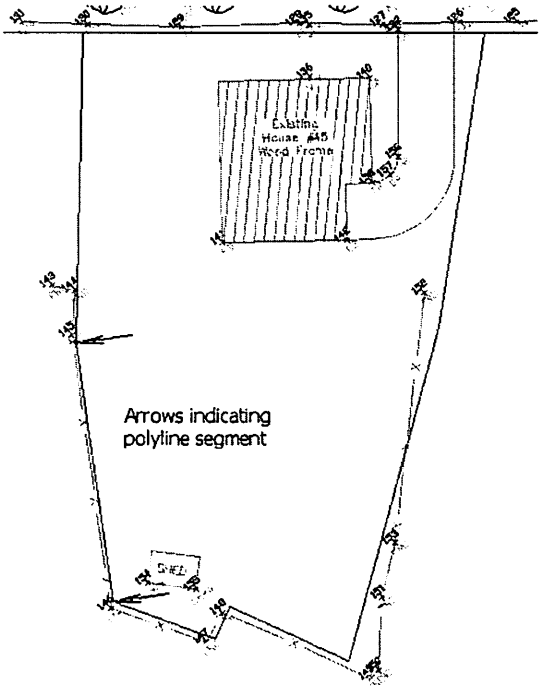
In a previous exercise, you used the **Standard Offset** command which offsets an entity a selected distance. In this exercise, you will use the **Variable Offset** command to offset a polyline with varying offset distances.

1. From the pull-down menu:
   Select **Edit ⇒ Offset ⇒ Variable Offset**

2. At the prompt *Vary offsets by line segments or at points [<Line>/Point]?* **L**

3. *Select a polyline to offset:* Pick the Polyline representing the Lot Lines.

4. *Select side to offset:* Pick a Point towards the center of the lot.



Temporary arrows are displayed indicating which segment of the lot line corresponds to the offset dimension being entered.

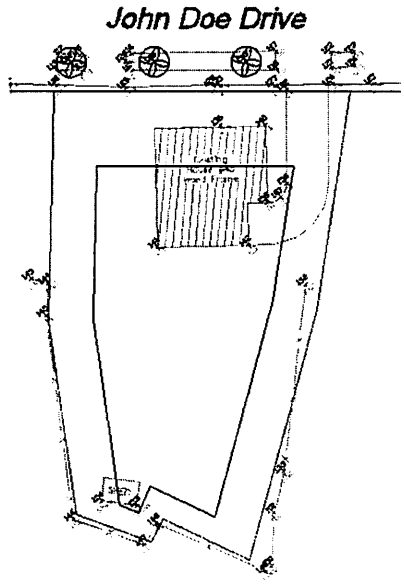
5. *Segment horizontal offset <0.000>:* **15** for a side yard offset.

6. Continue entering offset dimensions:

   - Side Yard = 15'
   - Front Yard = 25'
   - Rear yard = 8'

7. **Enter** to end the command.

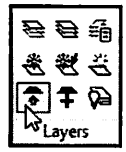
The command creates a single polyline at the entered offset dimensions.



Yes, the house encroaches into the front yard setback. It happens….

5.3.6 Create/Change Layers by Selection

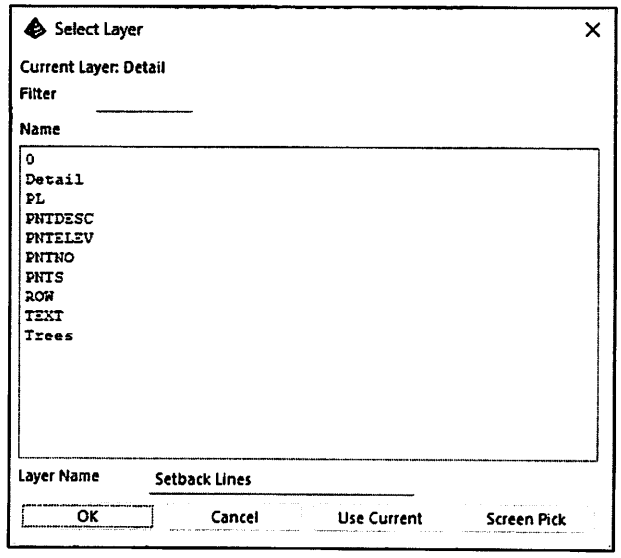
1. Select **Ribbon: Draft ⇒ Layers ⇒ Change Layer.**



Alternatively, from the pull-down menu: Select **View ⇒ Change Layer.**

2. At the prompt *Select entities to be changed:* **Select the Setback Polyline just created.**
3. Press **Enter.**
4. At the *prompt Specify new layer [Name/Current/<pick entity>]:* **N**

This opens the Select Layer dialog box



5. Enter a new layer name **Setback Lines.**
6. Click **<<OK>>**

The command changes the selected object to the layer Setback Lines.

Note: by using the *Screen Pick* option, you can pick any object in the drawing and the program will change your selection to that layer.

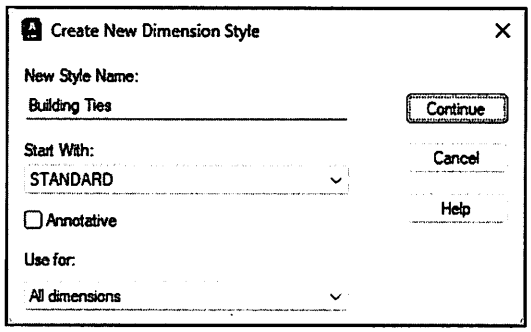
5.3.7 Adding Dimensions and Leaders

Dimensioning a plan can appear to be complicated because of the myriad of choices you have for each dimension. Properties like text style, precision, dimension type and dimension location are only a few of the options that can be set. This exercise will familiarize you with some of those choices but will demonstrate how setting only a few options can create desired results.

In this exercise you will:

- Create a dimension style
- Add dimensions to the drawing
- Modify a dimension style
- Draw a leader

Create a Dimension Style



1. From the pull-down menu: Select **Draw ⇒ Dimensions ⇒ Dimension Style.**
2. Click **<<New>>** to create a new style.

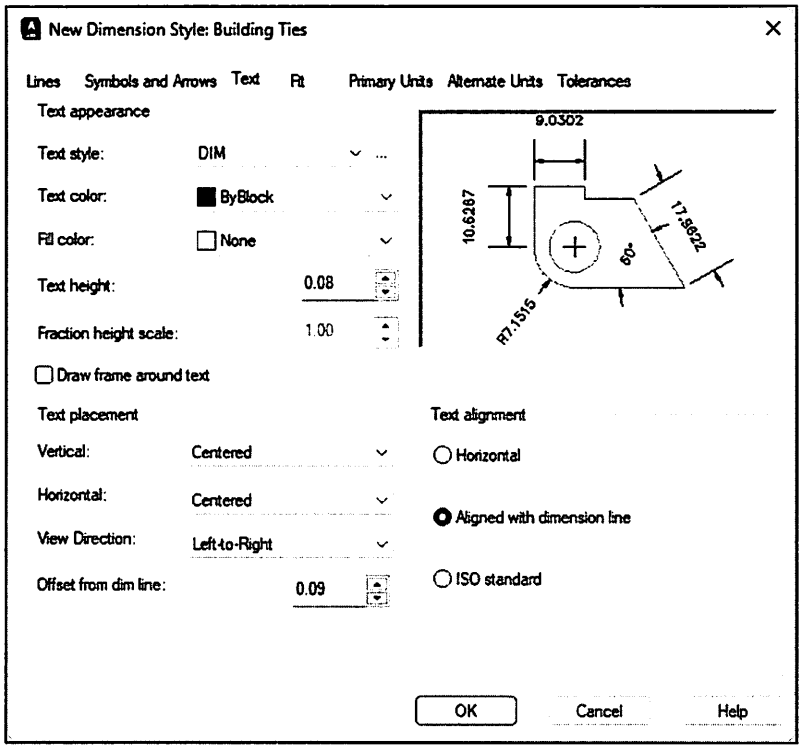
This opens the Create New Dimension Style dialog box.

3. Enter **Building Ties** for a New Style Name.
4. Click **<<Continue>>.**

This opens the *New Dimension Style* dialog box.

There are several tabs associated with various properties that control the function and display of dimensions. It becomes apparent very quickly just how many options are available to control dimensioning.

5. Select the **Text** tab.



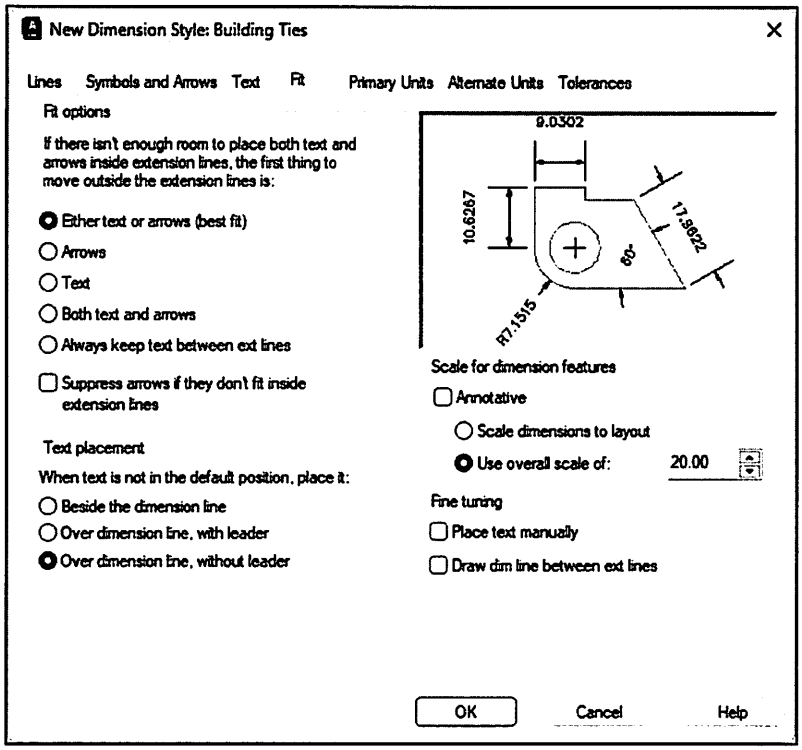
6. Set the **Text style** to **DIM**.

This text style was previously created with a height of 0. The text style and dimension style should be part of your template so you do not need to recreate them in each drawing.

7. Select the **Align with Dimension Line** option.

In IntelliCAD the option is called *Text Orientation* and there are two options. Set both to *Aligned with Line*.

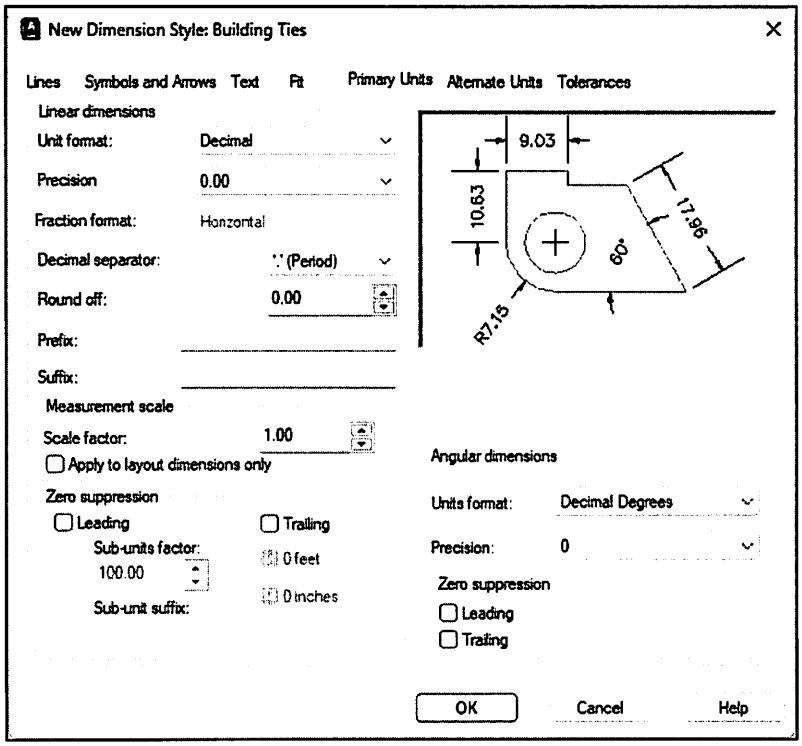
8. Select the **Fit** tab.



9. Confirm the **Scale for dimension features** option is set to **Use overall scale of: 20**.

This scale was set previously by the *Carlson Drawing Setup* command.

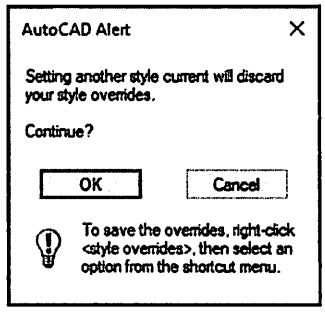
10. Select the **Primary Units** tab.



11. Set the **Precision** to **0.00** (2 decimal places).

12. Click **<<OK>>.**

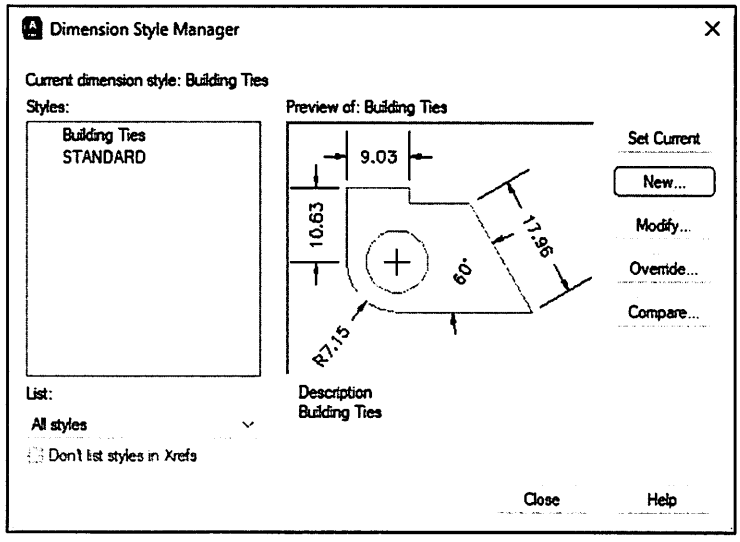
13. If prompted to discard style overrides, click **<<OK>>.**


AutoCAD Alert
Setting another style current will discard your style overrides.
Continue?
OK
Cancel
To save the overrides, right-click <style overrides>, then select an option from the shortcut menu.

This returns to the *Dimension Style Manager* dialog box.

Note how the display is updated for the new dimension style.

14. Click **<<Close>>.**



Add dimensions

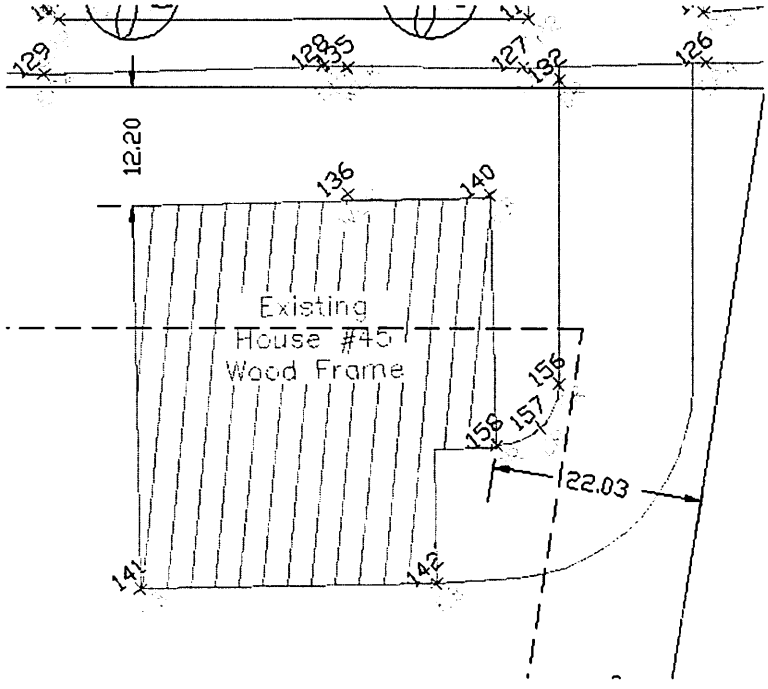
15. From the pull-down menu: Select **Draw ⇒ Dimensions ⇒ Linear ⇒ Aligned.**

16. At the prompt *Specify first extension line origin or <select object>:* **Pick the EndPoint** of the front corner of the house.

17. *Specify second extension line origin:* **Pick Perpendicular** to the front lot line.

18. Pick a location to **Place the Dimension.**

19. **Repeat** for the sideline of the house.



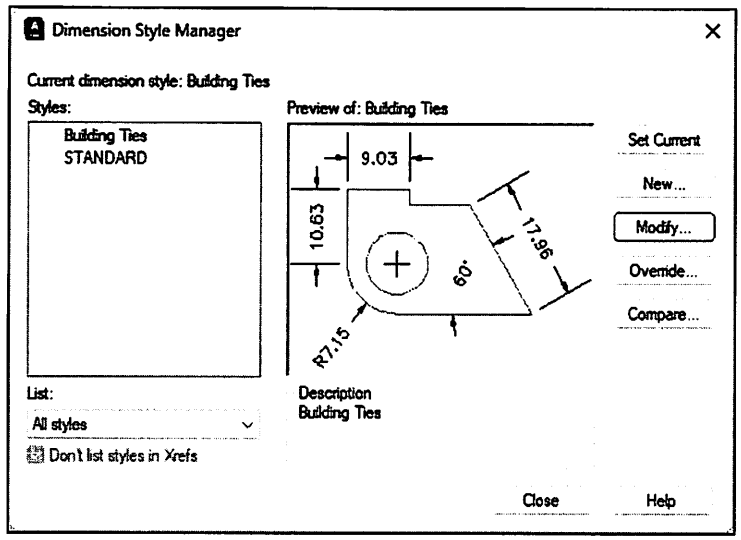
Modifying a Style

20. From the pull-down menu: Select **Draw ⇒ Dimensions ⇒ Dimension Style.**

This opens the *Modify Dimension Style* dialog box.

21. Confirm the *Style* **Building Ties** is selected.

22. Click **<<Modify>>.**



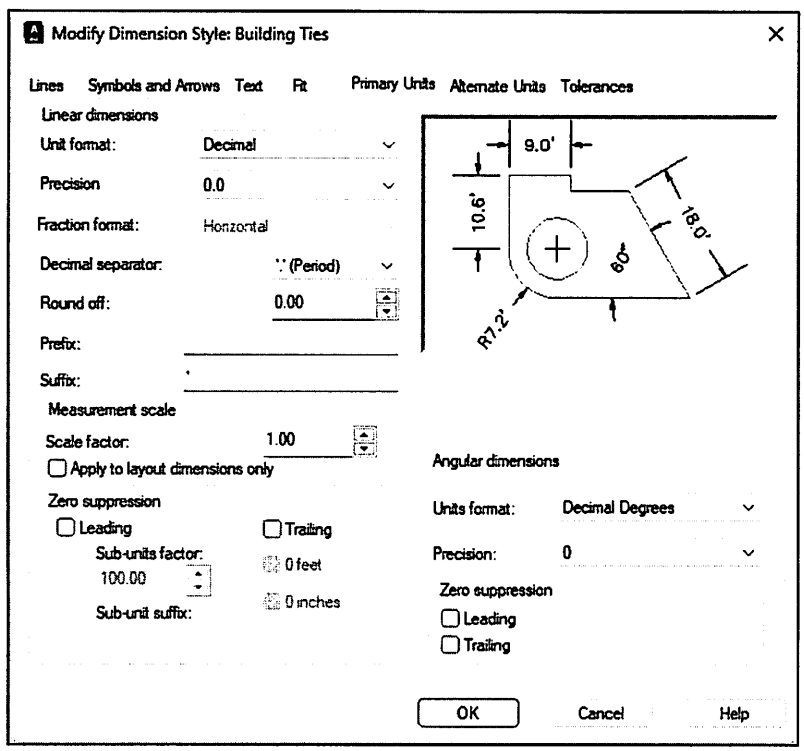
23. Click the **Primary Units** tab.

24. Set the **Precision** to **0.0** (single decimal place).

25. Enter a **Suffix** of **'** (foot sign).

26. Click **<<OK>>.**

27. From the *Dimension Style Manager* dialog box, click **<<Close>>.**



Notice how the dimensions automatically update with the new settings.

Add a Leader

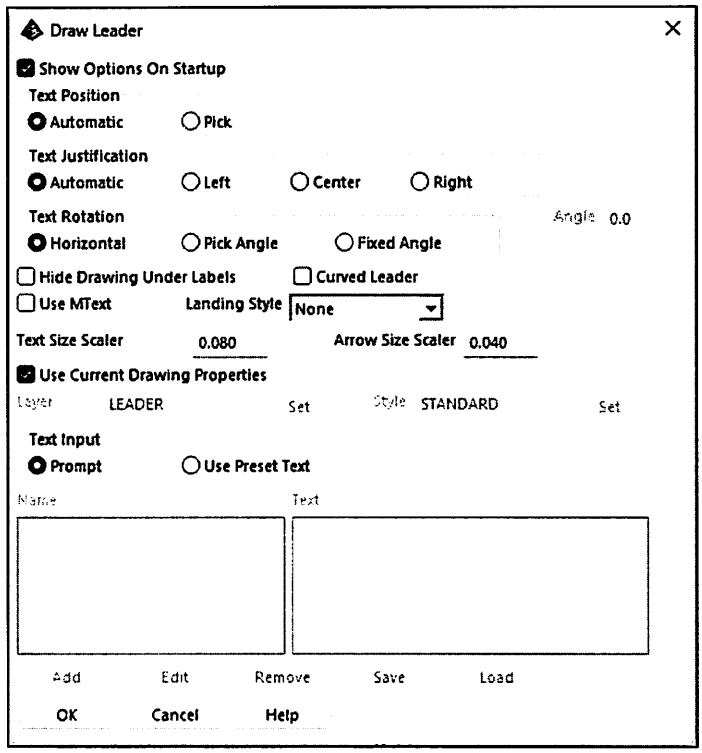
28. Zoom to a tree location.

29. From the pull-down menu: Select **Draw ⇒ Leader ⇒ Leader with Text.**

This opens the *Draw Leader* dialog box.

30. Set the options as shown to the right.

31. Click **<<OK>>.**

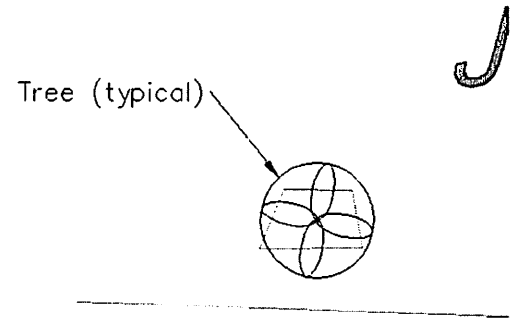


32. At the prompt *Options/Size/Pick Arrow Location:* starting with the arrowhead end of the leader, **pick the beginning and ending point of the leader.**

33. Press **Enter.**

34. Enter **Tree (typical)** for the leader text.

35. Press **Enter** when complete.



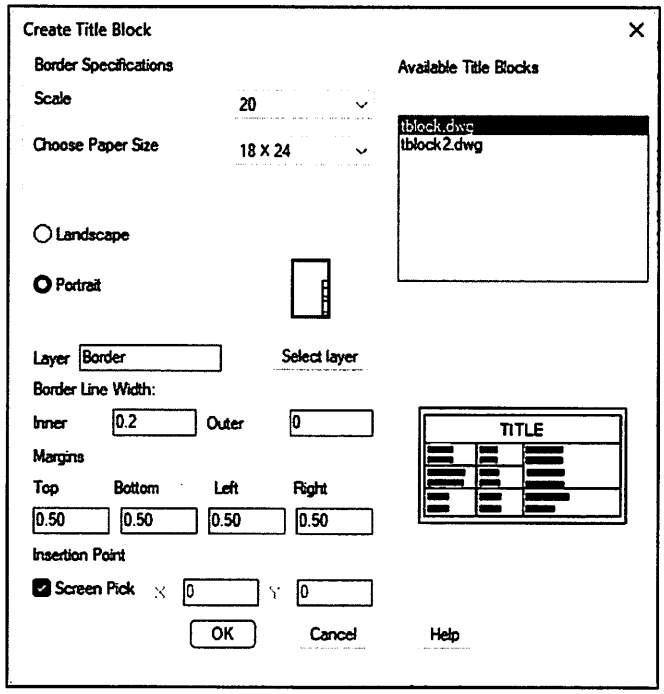
5.3.8 Drawing a Border and Title Block

Most companies develop some type of a standard pertaining to plan borders and title blocks. Carlson's title Block command draws a border for any sheet size at any drawing scale and imports a standard Title Block. This title Block is an external DWG that can be completely modified and used as a standard for all projects. Two title blocks are supplied and can be found in the **C:\Program Files\Carlson2023_ACAD21\SupTemplate** directory. Any custom title block can be created and saved in that directory for use.

1. From the pull-down menu: Select **Settings ⇒ Title Block ⇒ Standard.**

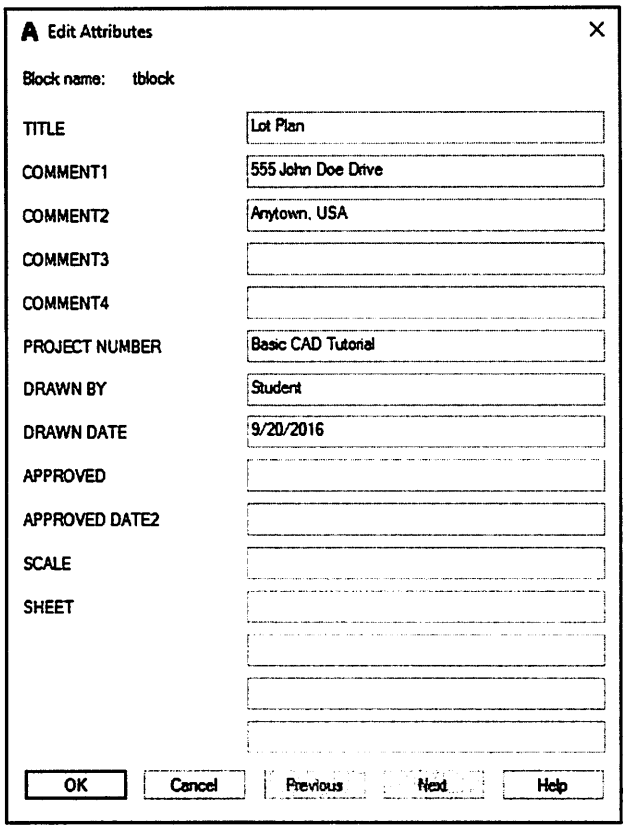
This opens the *Create Title Block* dialog box.

2. In the **Available Title Blocks** list select **tblock.dwg.**
3. Confirm the drawing **Scale** is set to **20.**
4. Set the **Choose Paper Size** option to **18x24.**
5. Select **Portrait.**
6. Enter the **Layer** name **Border.**
7. Set the **Inner Border Line Width** to **0.20.**
8. Set all **Margins** to **0.50.**
9. Click **<<OK>>.**



10. At the prompt *Pick location:* **Pick** a point for the **lower left corner** of the border

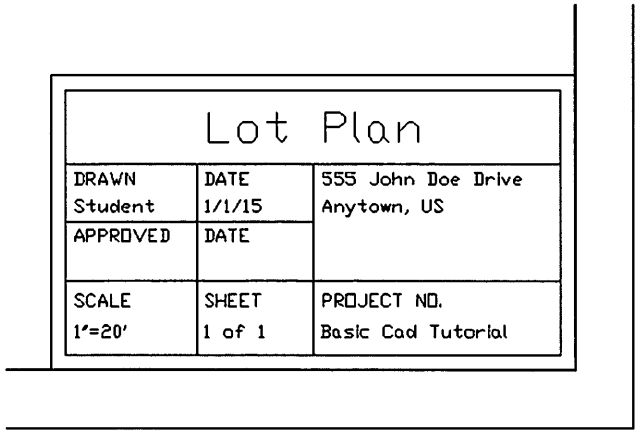
This opens the *Edit Attributes* dialog box.



11. Enter desired information for each comment section of the title block.

12. Click **<<OK>>.**

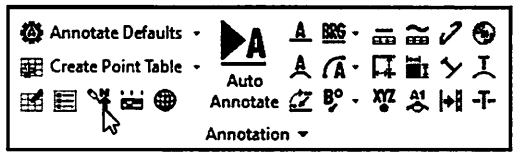
The command places the title block in the lower right corner of the border.



Remember: the title block is completely modifiable. It can be edited and customized for each individual user, project or municipal standard.

5.3.9 Adding a North Arrow

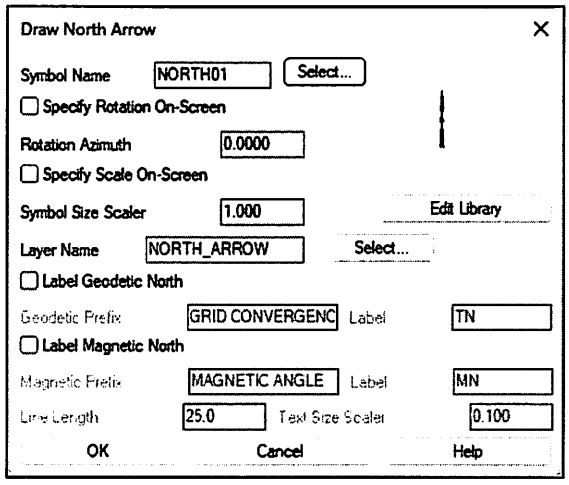
1. Select **Ribbon: Annotation ⇒ Annotation ⇒ Draw North Arrow.**



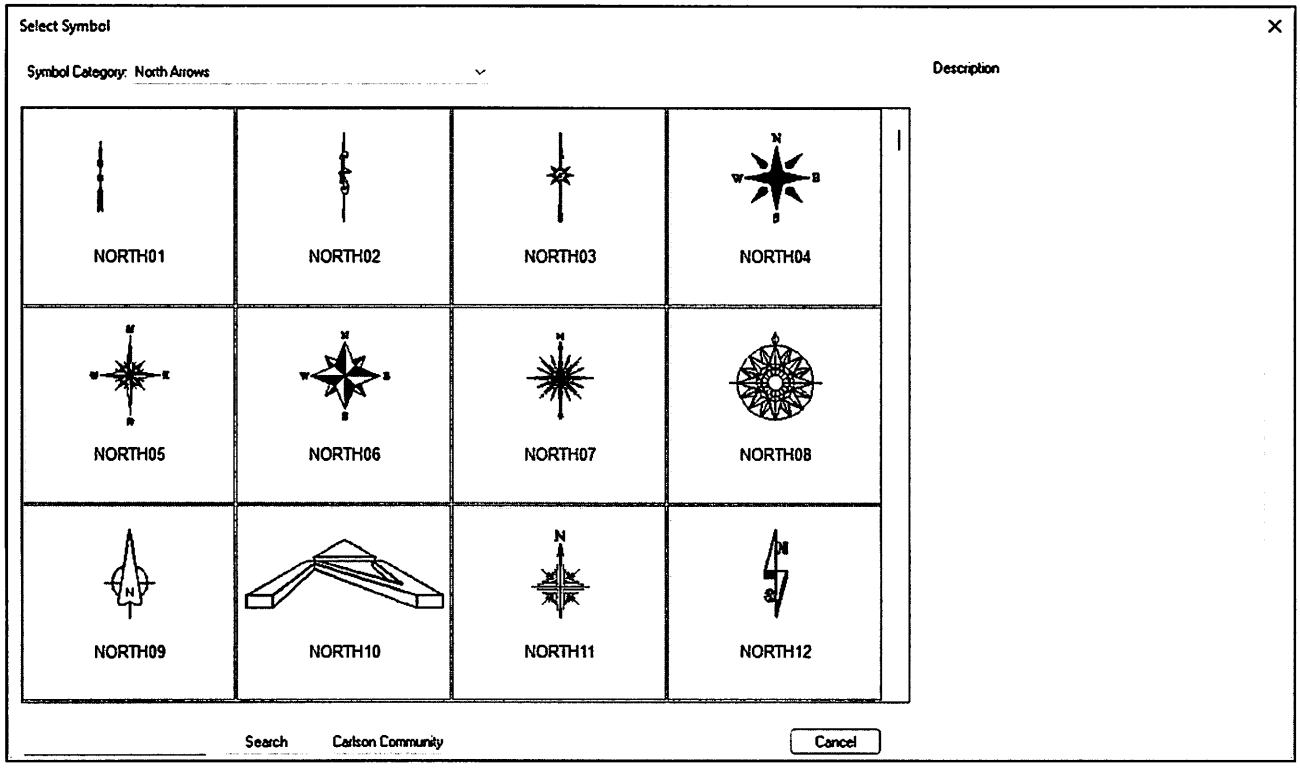
Alternatively, from the pull-down menu:
Select **Annotate ⇒ Draw North Arrow.**

This opens the *Draw North Arrow* dialog box

2. Click **<<Select>>.**



The *Select Symbol* dialog box opens.

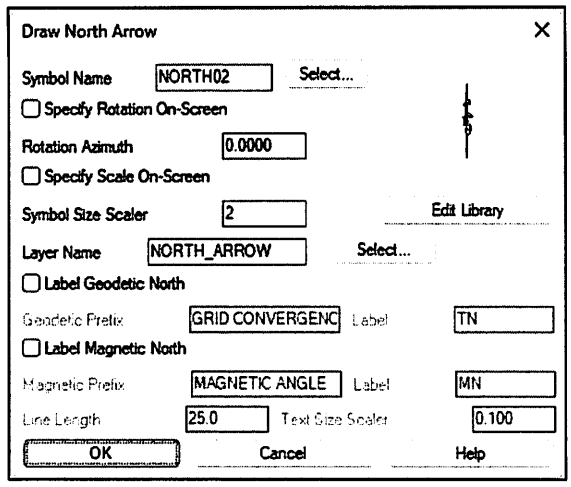


3. Scroll through the library and select a *North Arrow*.

4. Back in the *Draw North Arrow* dialog box, set the **Symbol Size Scaler** to **2.** This will vary depending on the *North Arrow* chosen.

5. Set **the Layer Name** to **North_Arrow.**

6. Click **<<OK>>.**

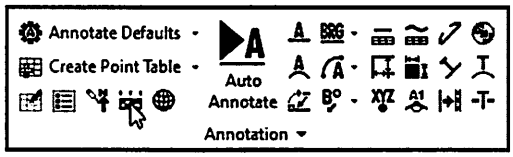


7. At the prompt *Specify insertion point:* **Pick a Point** on the screen for the *North Arrow.*

If you would like to change the position of the north arrow it can be moved with basic AutoCAD commands.

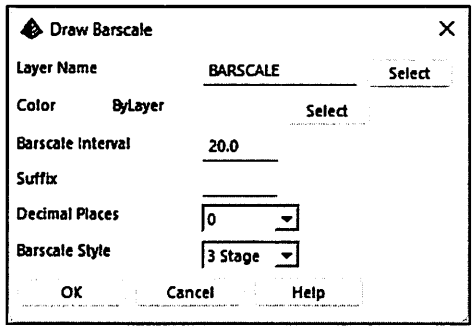
5.3.10 Adding a Bar Scale

1. Select **Ribbon: Annotation ⇒ Annotation ⇒ Draw Barscale.**

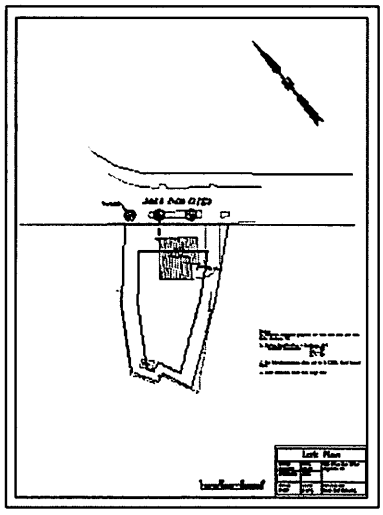


Alternatively, from the pull-down menu:
Select **Annotate ⇒ Draw Barscale.**

This opens the *Draw Bar Scale* dialog box.



2. Enter the **Layer Name Barscale.**
3. Confirm the **Horizontal Scale** is set to **20.**
4. Click **<<OK>>.**
5. At the prompt *Pick location for barscale:* **Pick a Point** on the screen for the *Bar Scale.*

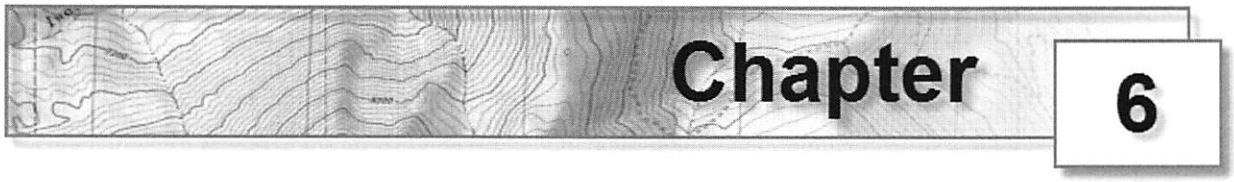


Lesson Review

In this lesson you were introduced to many tools used to enhance your drawing and create objects such as title blocks, notes and bar scales. Many of these can be customized for individual preference or more universal standards.

Chapter Review

In this chapter you gained an understanding of Carlson's drawing and editing tools. You were exposed to multiple commands to create a drawing from point data and bring it to completion. It is well worth the time to set up standards for drafting that can be utilized throughout the command sequences, ensuring consistency in plan preparation as well as accuracy of the drawing itself.



6 - More Essential Tools

Introduction

In this chapter, you learn how to use ten more valuable features in *Carlson Software*.

Lesson: Drawing Cleanup

Drawing cleanup is a robust utility that scans an entire drawing or part of a drawing for a wide range of common errors found in many drawing files.

Lesson: Labeling Lines

Labeling lines in Carlson Software is a simple process. The labels can be static or dynamic.

Lesson: Annotative Text and Points

An alternative to creating text styles for each drawing scale is to use Annotative Text. Annotative text is placed in the drawing once and automatically changes height with the drawing scale.

Lesson: Working with Centerlines

Carlson Software has the ability to work with 2D alignments, known as centerlines in the software.

Lesson: LandXML Export/Import

Land XML is a universal file format used to store and transfer civil/survey data. In this lesson you learn how to Export and Import LandXML data out of and into your Project.

Lesson: Google Earth Export/Import

Carlson Software supports the export of drawing entities in Google Earth formats, as well as the import of Google Earth files.

Lesson: Quick Keys

Carlson Software provides the ability to customize one and two letter keyboard shortcuts as user input, known as Quick Keys in the program.

Lesson: Working with the Symbol Library

The Symbol Library is the tool that Carlson Software uses to organize and provide access to symbols.

Lesson: Import ESRI SHP Files

Much data is available from a wide variety of sources in an ESRI SHP file format. Carlson Software can import these files, with or without the associated data.

Lesson: Place Image by World File

Much aerial imagery is also available from a wide variety of sources, and Carlson Software supports the import and geo-referencing of these images.

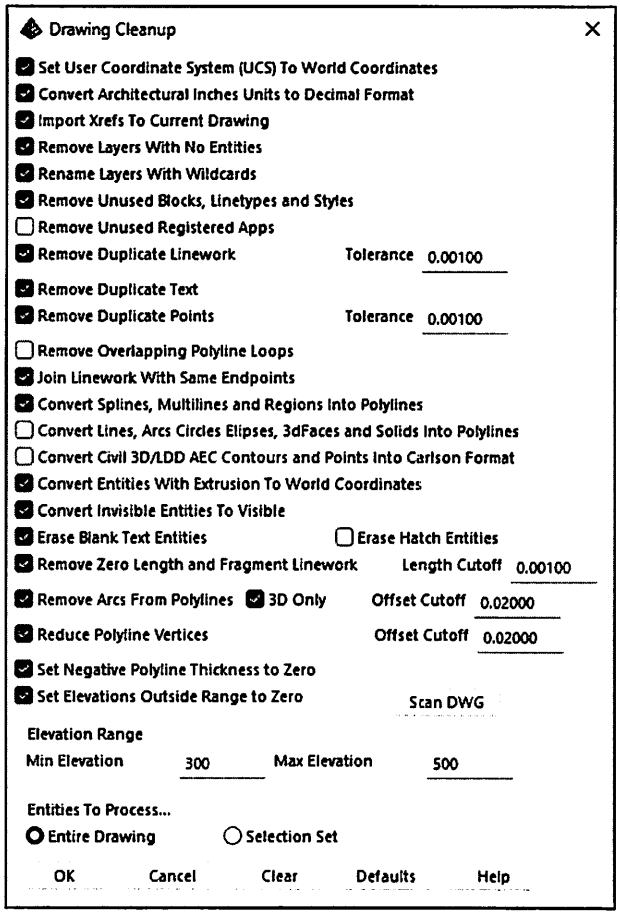
Lesson: Working with Civil 3D Data

Create a new drawing containing AutoCAD Civil 3D Points from Carlson Point Blocks. Then open a drawing with Civil 3D objects and convert it to Carlson project data.

6.1 Lesson: Using Drawing Cleanup

Introduction

Drawing cleanup is a robust utility in *Carlson* that scans an entire drawing or part of a drawing for a wide range of common errors found in many drawing files. Each specific error type can be activated or deactivated in the scan. Many error types have tolerance ranges that can be applied to fine-tune the error corrections.



Key Concepts

Concepts and key terms covered in this lesson are:

- Drawing Cleanup
- Drawing Cleanup Options
- Drawing Cleanup Tolerances

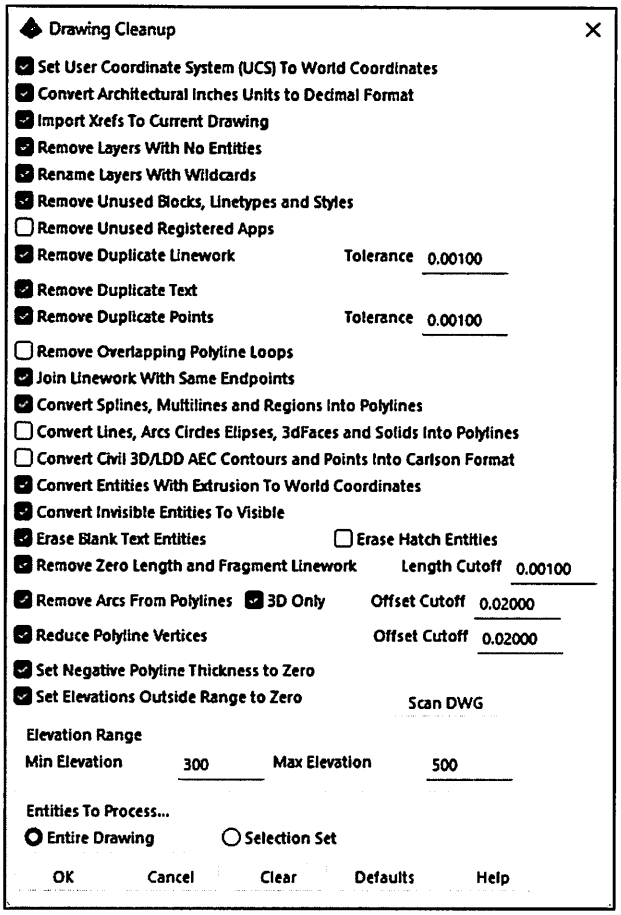
Objectives

After completing this lesson, you will be able to:

- Employ the Drawing Cleanup feature to quickly repair many typical drawing errors

Drawing Cleanup

The *Drawing Cleanup* command can fix many types of drawing errors or abnormalities.



Most of the options to correct errors are really quite self-explanatory. While all of the options can potentially be extremely useful, some of the most commonly used are:

- Remove Duplicate Linework
- Remove Duplicate Points
- Join Linework With Same Endpoints
- Convert Land Desktop Contours and Points Into Carlson Format
- Remove Zero Length and Fragment Linework
- Reduce Polyline Vertices
- Set Elevations Outside Range to Zero

You can choose to process the entire drawing all at once, or a selection set of entities.

Exercise: Drawing Cleanup

In this exercise you use the Drawing Cleanup command.

You do the following:

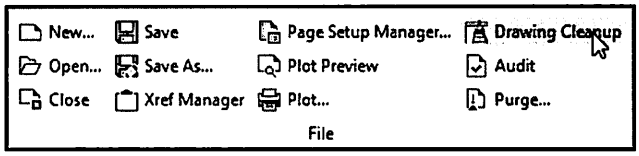
- Access Drawing Cleanup
- Review the many options
- Clean a Drawing

6.1.1 Using Drawing Cleanup

NOTE: Instructions for Downloading and Installing the Datasets can be found on page vi.

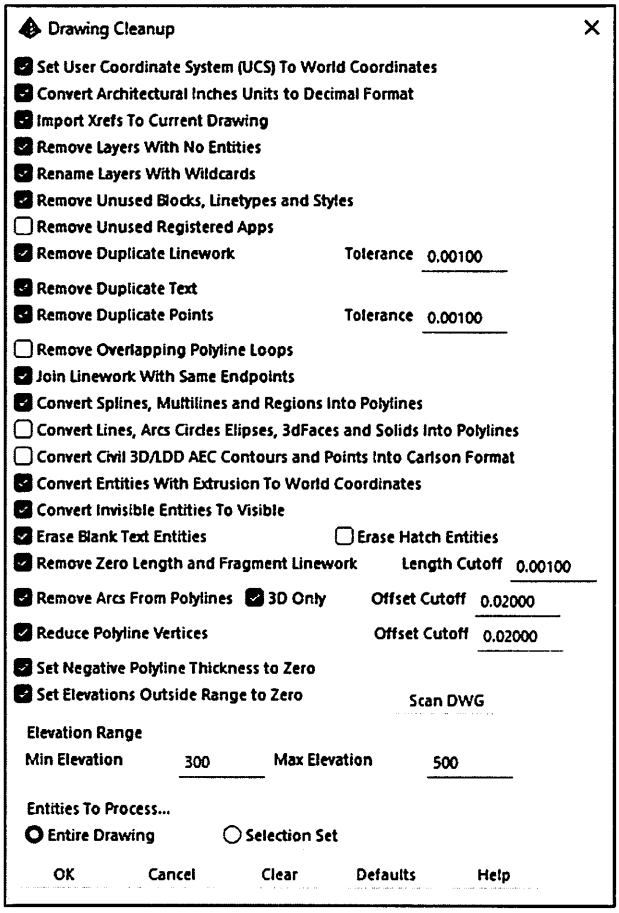
1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_1\DWGS\6_1.dwg**

2. Select **Ribbon: File ⇒ FIle ⇒ Drawing Cleanup.**



Alternatively, from the pull-down menu:
Select **File ⇒ Drawing Cleanup.**

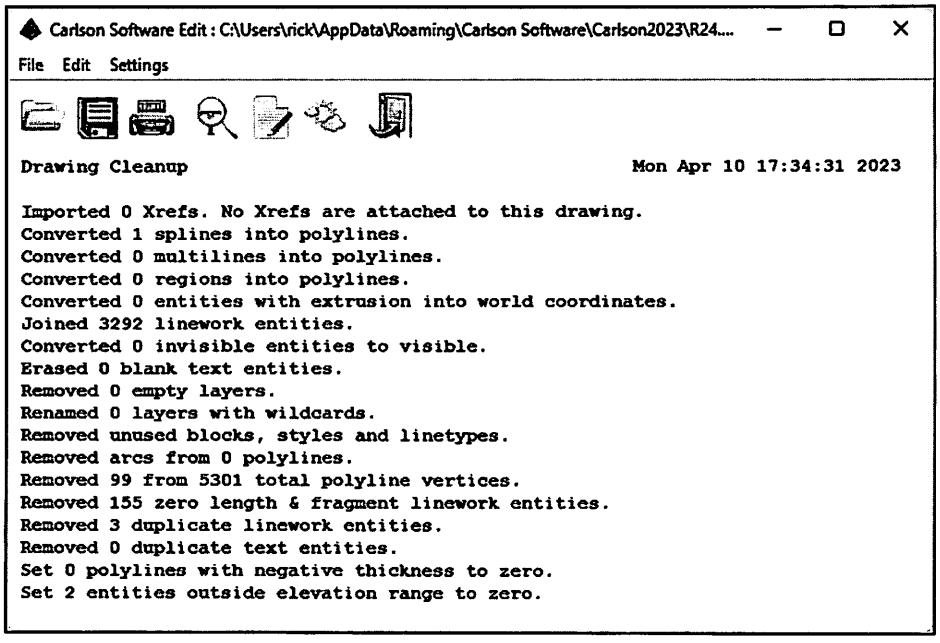
This opens the *Drawing Cleanup* dialog box.



3. Set the Drawing Cleanup options as shown.

4. Click **<<OK>>.**

5. A detailed report is generated listing the cleanup options that were executed and the results of each.


Carlson Software Edit : C:\Users\rick\AppData\Roaming\Carlson Software\Carlson2023\R24....
File Edit Settings
Drawing Cleanup
Mon Apr 10 17:34:31 2023
Imported 0 Xrefs. No Xrefs are attached to this drawing.
Converted 1 splines into polylines.
Converted 0 multilines into polylines.
Converted 0 regions into polylines.
Converted 0 entities with extrusion into world coordinates.
Joined 3292 linework entities.
Converted 0 invisible entities to visible.
Erased 0 blank text entities.
Removed 0 empty layers.
Renamed 0 layers with wildcards.
Removed unused blocks, styles and linetypes.
Removed arcs from 0 polylines.
Removed 99 from 5301 total polyline vertices.
Removed 155 zero length & fragment linework entities.
Removed 3 duplicate linework entities.
Removed 0 duplicate text entities.
Set 0 polylines with negative thickness to zero.
Set 2 entities outside elevation range to zero.

If the results of the drawing cleanup are unsatisfactory in any way you can simply Undo the operation and try again.

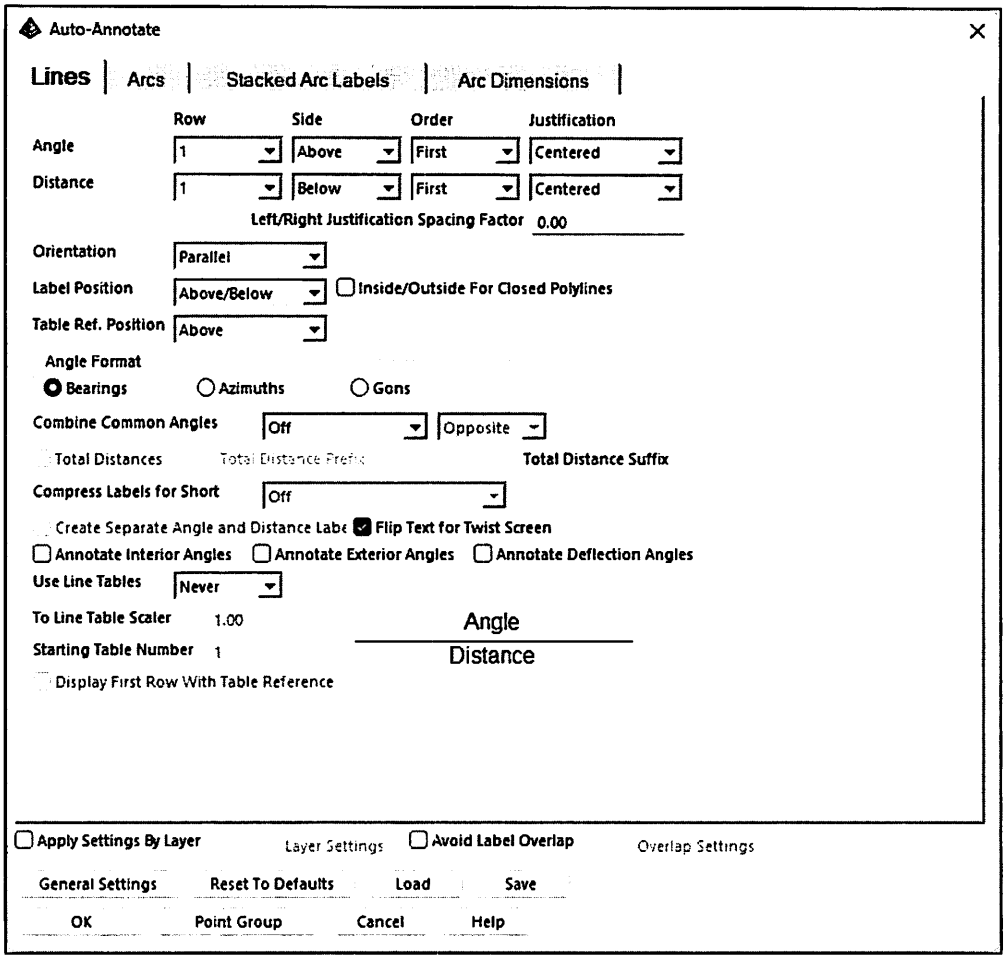
Lesson Review

In this lesson, you learned of the Drawing Cleanup feature in *Carlson Software*, what it does, and how and why to use it.

6.2 Lesson: Labeling Lines

Introduction

Labeling lines in *Carlson Software* is a simple process. The labels can be static or dynamic.



Key Concepts

Concepts and key terms covered in this lesson are:

- Link Labels with Linework
- Annotate Defaults
- Auto Annotate

Objectives

After completing this lesson, you will be able to:

- Set labeling to static or dynamic
- Set Annotation Defaults
- Execute Auto Annotate

Link Labels with Linework

In the *General Settings* dialog box there is an option to *Link Labels with Linework*. When this option is enabled the labels are dynamic and automatically update any time the associated linework is modified. When this option is disabled the labels are static and do not update if the linework is edited.

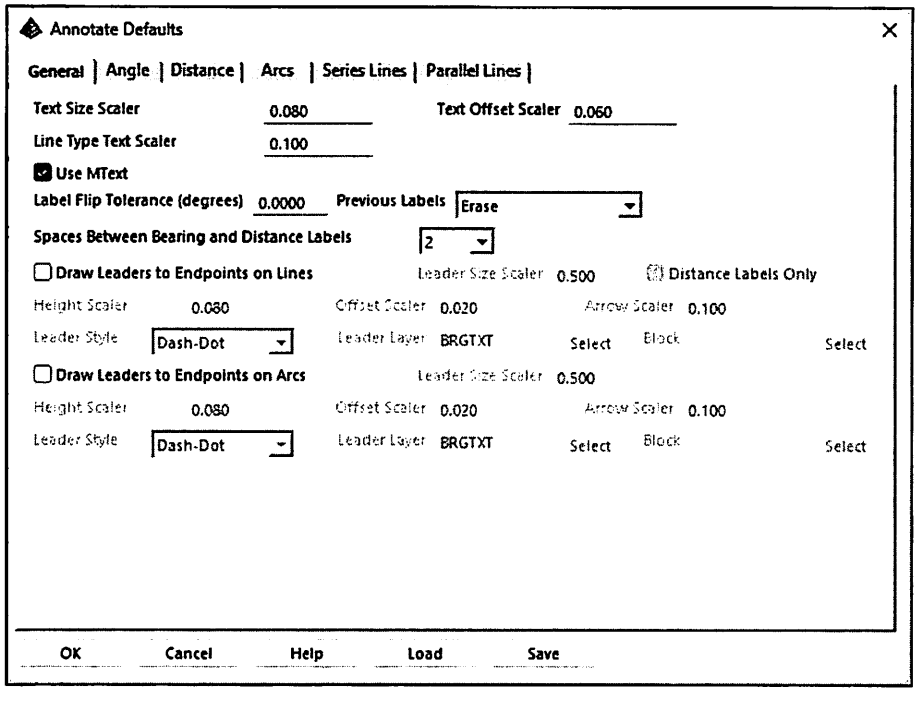
Annotate Defaults

The Annotate Defaults control the settings for line and curve labeling functions. All of the settings on all of the tabs can be saved as an external .ADF file. Different .ADF files can be created for different labeling requirements and specifications. The saved .ADF files can be loaded by other end users to enable standardized labeling results.

General Tab

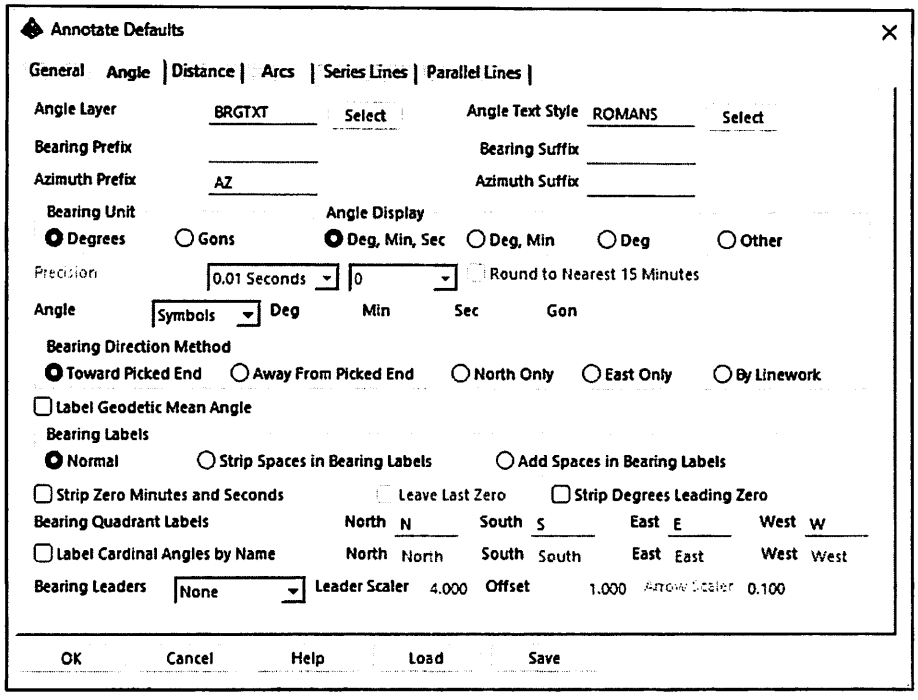
As with most Carlson dialog boxes, most of the available options are generally self-explanatory, and are described with simple and commonly used terminology. If any options are not clear, there is always a Help button available, which describes each option in depth. In summary, though, the General tab in Annotate Defaults is used to:

- Text Size Scaler - what size you want the text to plot on paper, in inches for English (Imperial) drawings, cm for Metric drawings
- Whether to use Mtext or Dtext, and/or Annotative text
- Whether to draw leaders from the endpoints or lines and/or curves



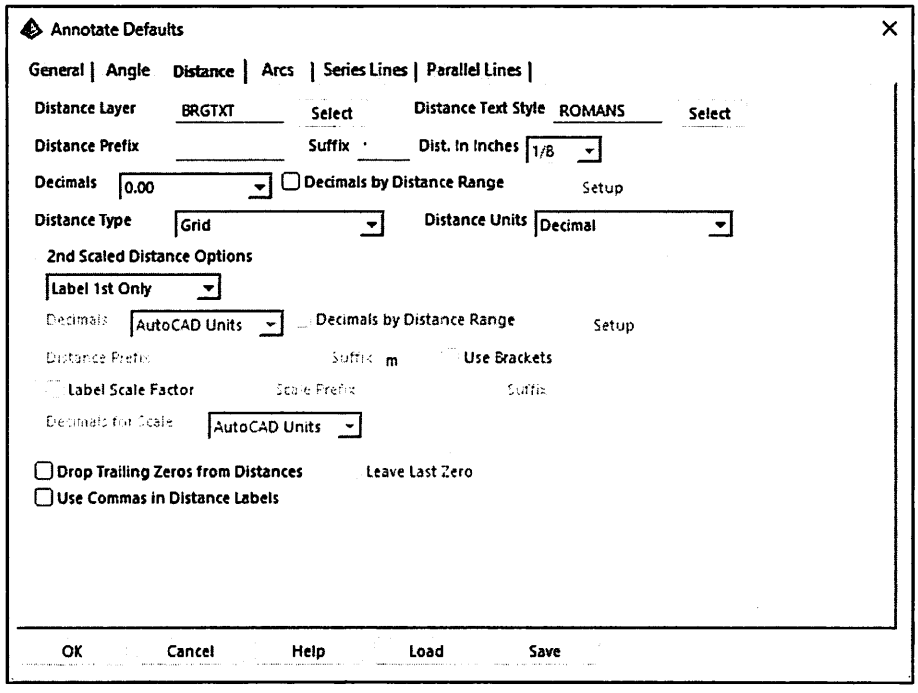
Angle Tab

The *Angle* tab provides a wide range of options to control the overall and specific appearance of Bearings.


Annotate Defaults
General Angle Distance Arcs Series Lines Parallel Lines
Angle Layer BRGTXT Select
Angle Text Style ROMANS Select
Bearing Prefix
Bearing Suffix
Azimuth Prefix AZ
Azimuth Suffix
Bearing Unit
Degrees Gons
Angle Display
Deg, Min, Sec Deg, Min Deg Other
Precision 0.01 Seconds 0 Round to Nearest 15 Minutes
Angle Symbols Deg Min Sec Gon
Bearing Direction Method
Toward Picked End Away From Picked End North Only East Only By Linework
Label Geodetic Mean Angle
Bearing Labels
Normal Strip Spaces in Bearing Labels Add Spaces in Bearing Labels
Strip Zero Minutes and Seconds Leave Last Zero Strip Degrees Leading Zero
Bearing Quadrant Labels North N South S East E West W
Label Cardinal Angles by Name North North South South East East West West
Bearing Leaders None Leader Scaler 4.000 Offset 1.000 Arrow Scaler 0.100
OK Cancel Help Load Save

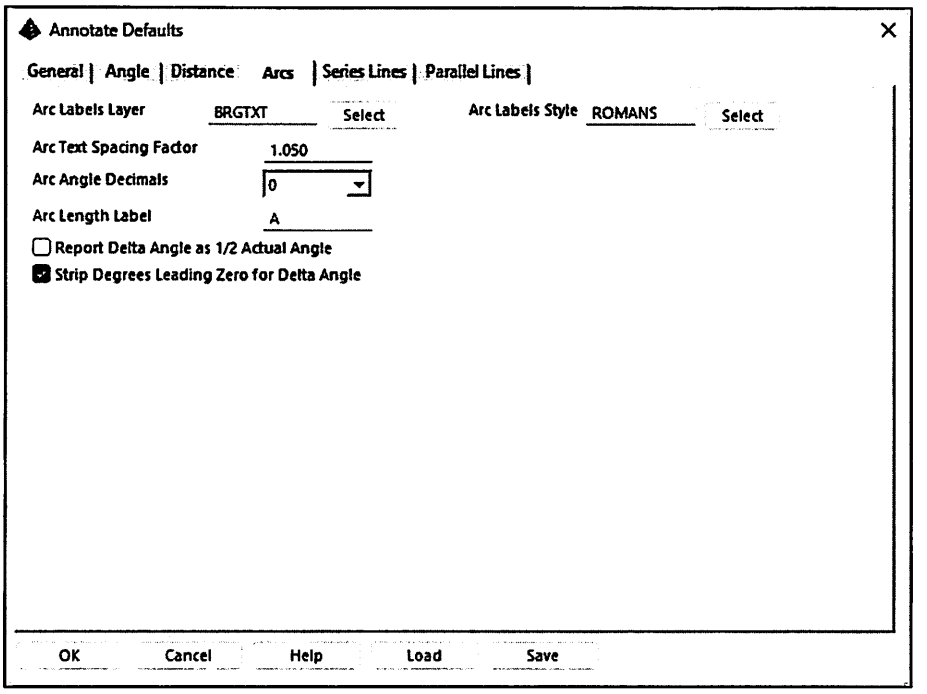
Distance Tab

The *Distance* tab is where the generation of Distance labels is set. Again, these are mostly quite straightforward and self-explanatory. One interesting option here is to generate a second distance label for each line, with alternate units. This can be very useful to display distances in feet and meters simultaneously, for instance.


Annotate Defaults
General Angle Distance Arcs Series Lines Parallel Lines
Distance Layer BRGTXT Select
Distance Text Style ROMANS Select
Distance Prefix
Suffix
Dist. In Inches 1/8
Decimals 0.00 Decimals by Distance Range Setup
Distance Type Grid
Distance Units Decimal
2nd Scaled Distance Options
Label 1st Only
Decimals AutoCAD Units Decimals by Distance Range Setup
Distance Prefix Suffix m Use Brackets
Label Scale Factor Scale Prefix Suffix
Decimals for Scale AutoCAD Units
Drop Trailing Zeros from Distances Leave Last Zero
Use Commas in Distance Labels
OK Cancel Help Load Save

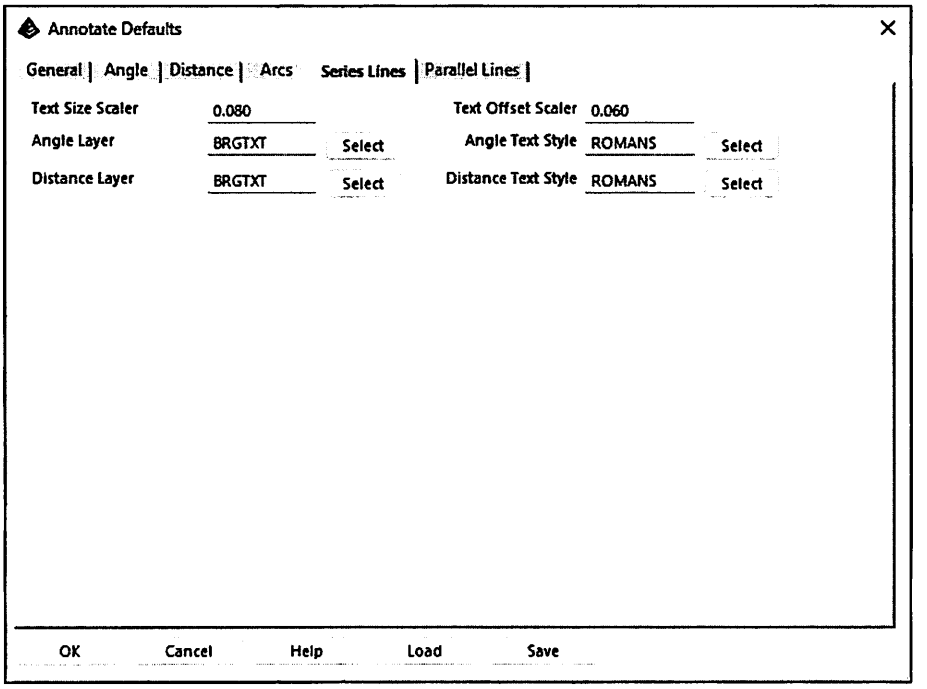
Arcs Tab

These are the settings for labeling arcs.



Series Lines and Parallel Lines Tabs

These two tabs control labeling settings for these specific situations. Series lines share a common bearing, and the bearing can be set to be labeled only once to avoid clutter. Parallel lines can have the bearing removed for all but the outermost lines, again, to remove clutter.



Auto Annotate

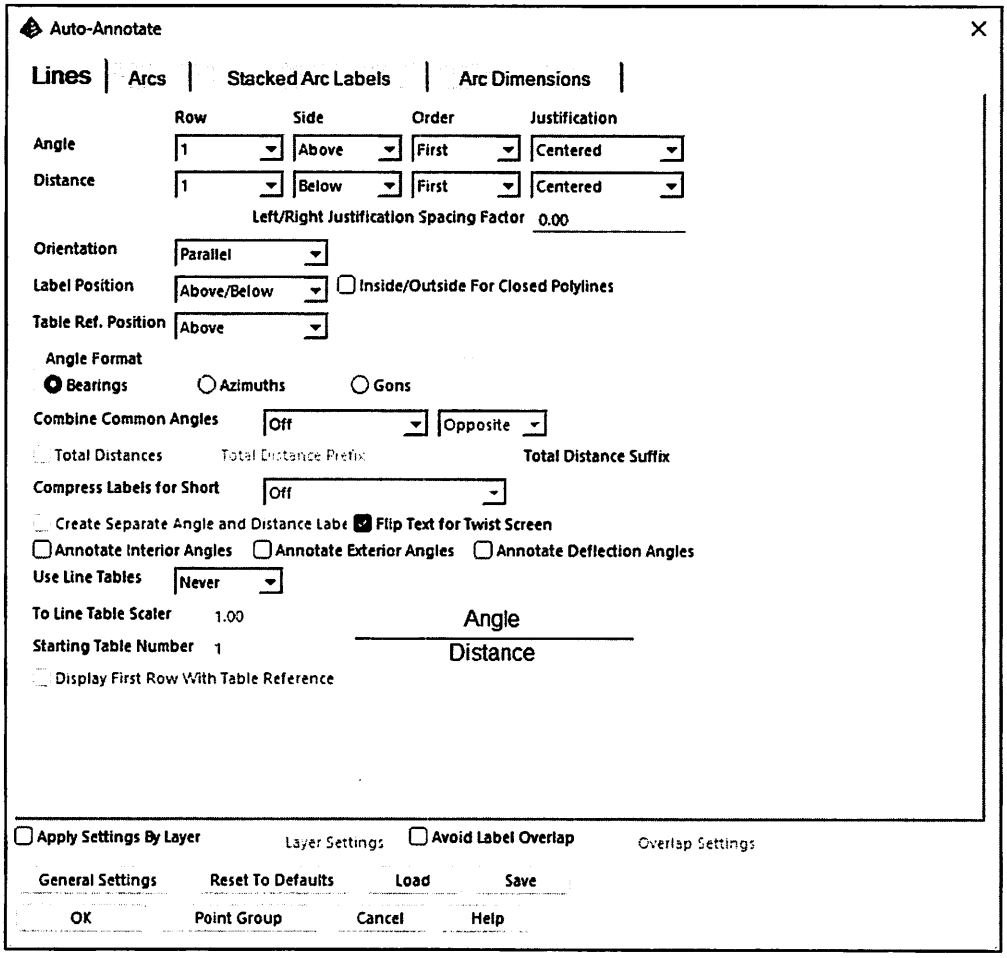
The Auto Annotate command is designed to be utilized to quickly label a large number of lines and/or arcs with a single execution of the command.

Auto-Annotate dialog box

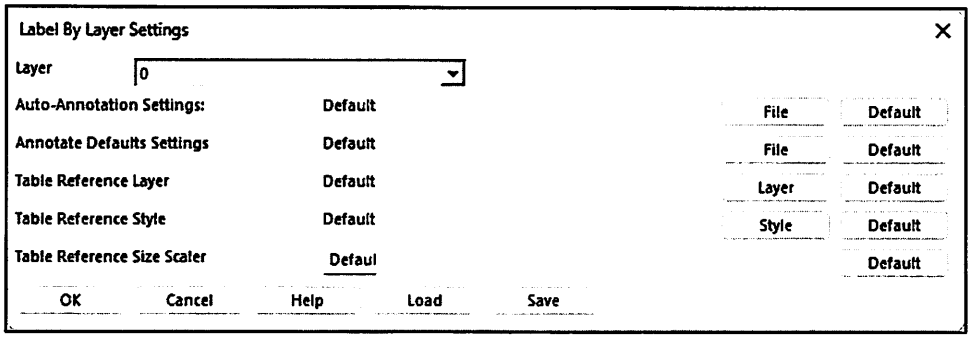
The Auto-Annotate dialog box is where all the settings for the labels are set, in concert with the Annotate Defaults discussed previously. Once set, the <<*OK*>> button initiates the actual labeling function.

Lines tab

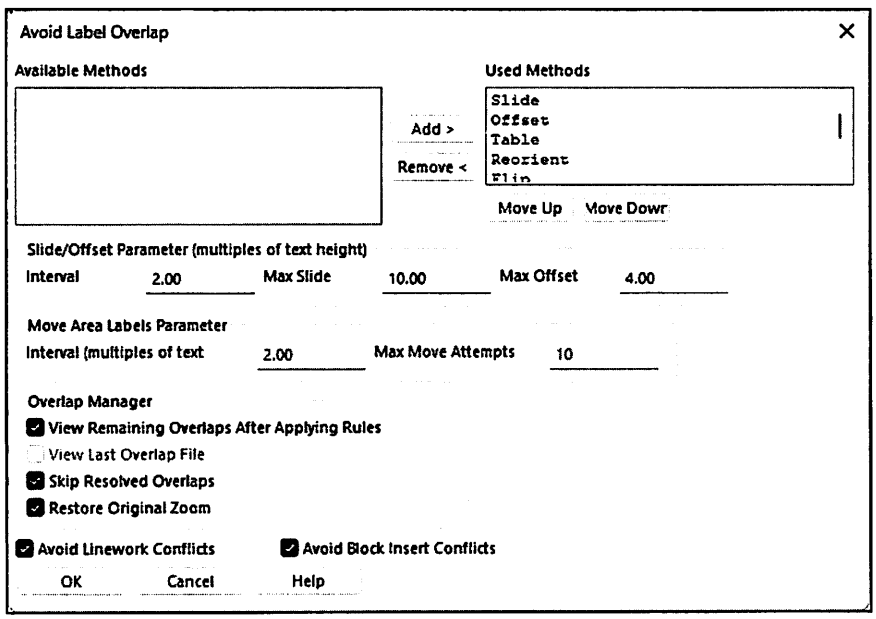
Here you set what is to be labeled above and/or below the line, along with the order, justification, and orientation of the labels. This is also where the use of Tables is specified, and if so, what criteria determines if labels are listed there or drawn on the lines themselves. There is also a preview of the settings shown at the bottom of the tab.



As a fairly sophisticated implementation of *Auto Annotate*, there is the option to Apply Settings By Layer, which allows you to have linework on different layers use different labeling settings.



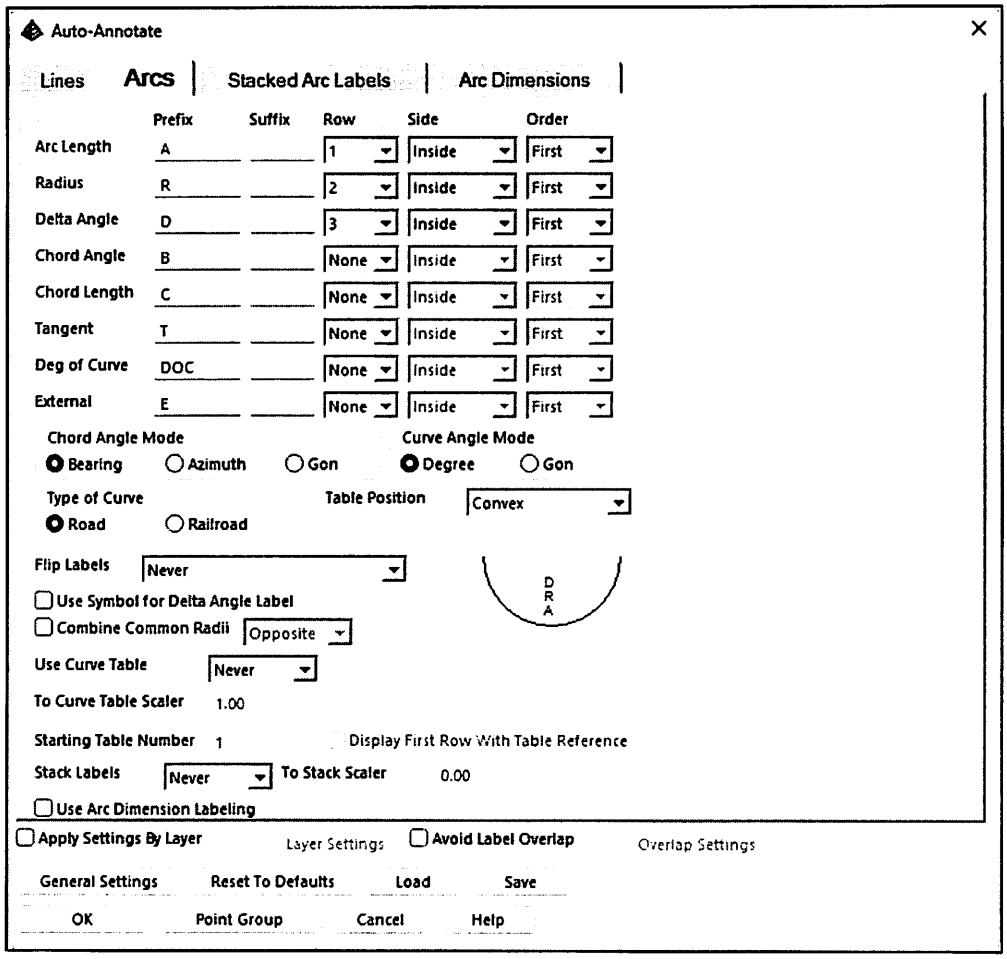
There is also a highly advanced function to automatically find and fix labeling overlaps. Avoid Label Overlaps provides seven methods to resolve overlaps, and you set the order in which they are applied.



These two capabilities are not covered in detail in this text, but give them a try on your own.

Arcs tab

This tab contains all the settings for labeling arcs, again, used in conjunction with the *Annotate Defaults*. Similar options to those for Lines labels are available here, specific to arc data of course. You decide what data to label, in what order, in what location relative to the arc. You also decide what criteria determine when labels are not used in favor of listing the arc data in a Table. Layer and Overlap controls can also be applied to Arc labels.



Exercises: Labeling Lines

In these exercises you adjust the Label Linking settings, Review Annotation Defaults, use Auto Annotate to label lines. You then edit the lines to see the labels respond.

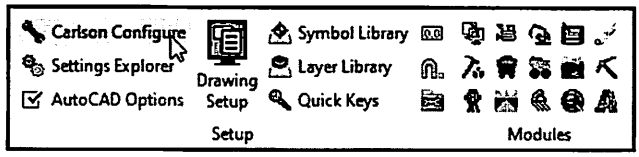
You do the following:

- Set Linking Setting
- Adjust Annotation Defaults
- Use Auto Annotate to Label Lines
- Grip Edit lines to observe dynamic labeling

6.2.1 Set Linework Label Linking

1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_2\DWGS\6_2.dwg**

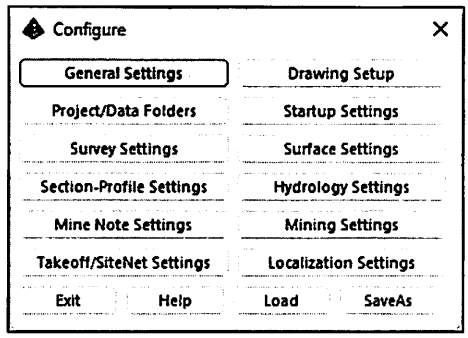
2. Select **Ribbon: Setup ⇒ Setup ⇒ Carlson Configure.**



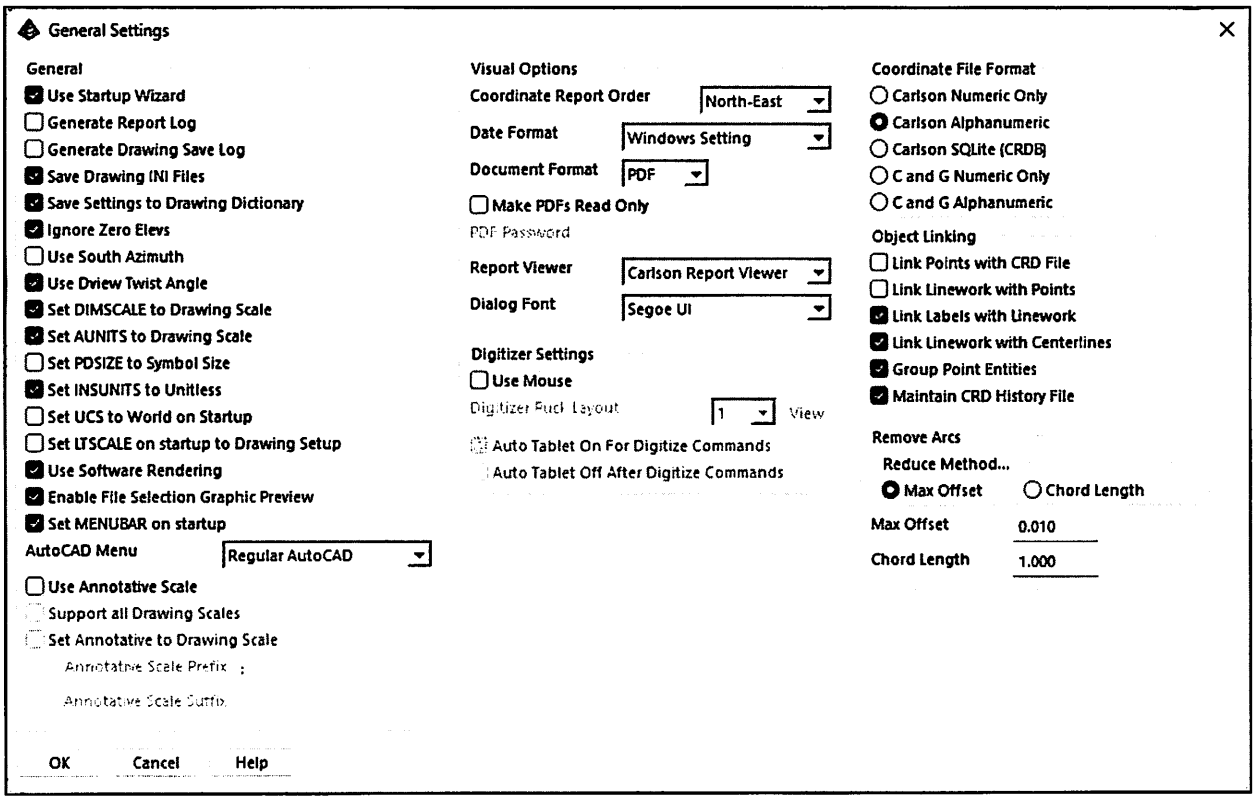
Alternatively, from the pull-down menu:
Select **Settings ⇒ Carlson Configure.**

The *Configure* dialog box is opened.

3. Click **<<General Settings>>.**



The *General Settings* dialog box is opened.



4. In the **Object Linking** section, enable the option to **Link Labels with Linework**.

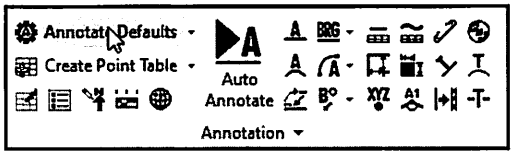
5. Click **<<OK>>** to save the changes.

6. Back in the *Configure* dialog box, click **<<Exit >>**.

6.2.2 Annotate Defaults

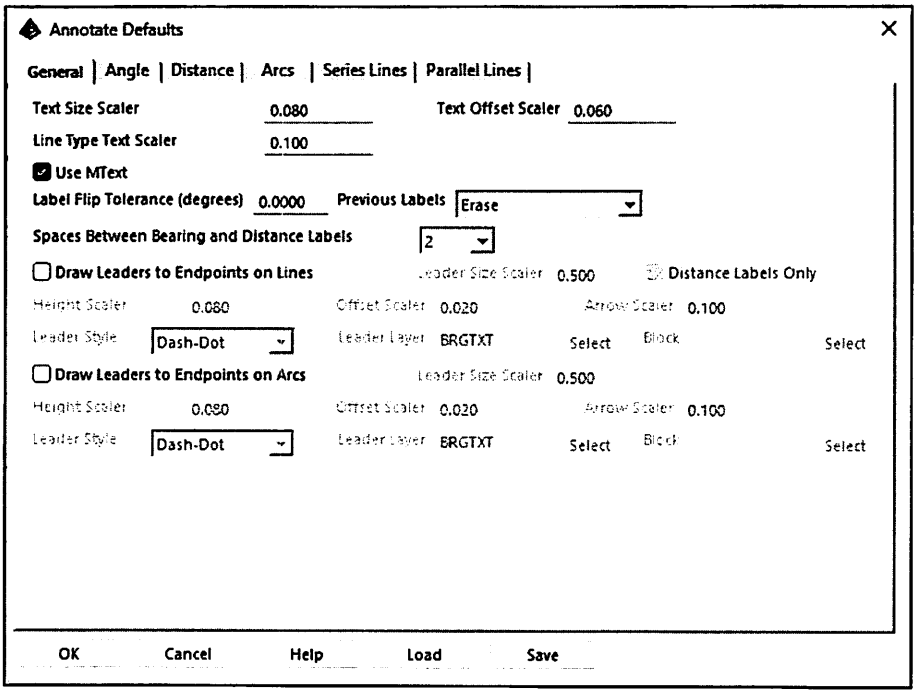
1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Annotation ⇒ Annotation ⇒ Annotation Defaults.**



Alternatively, from the pull-down menu:
Select **Annotate ⇒ Annotate Defaults.**

The *Annotate Defaults* dialog box is opened.

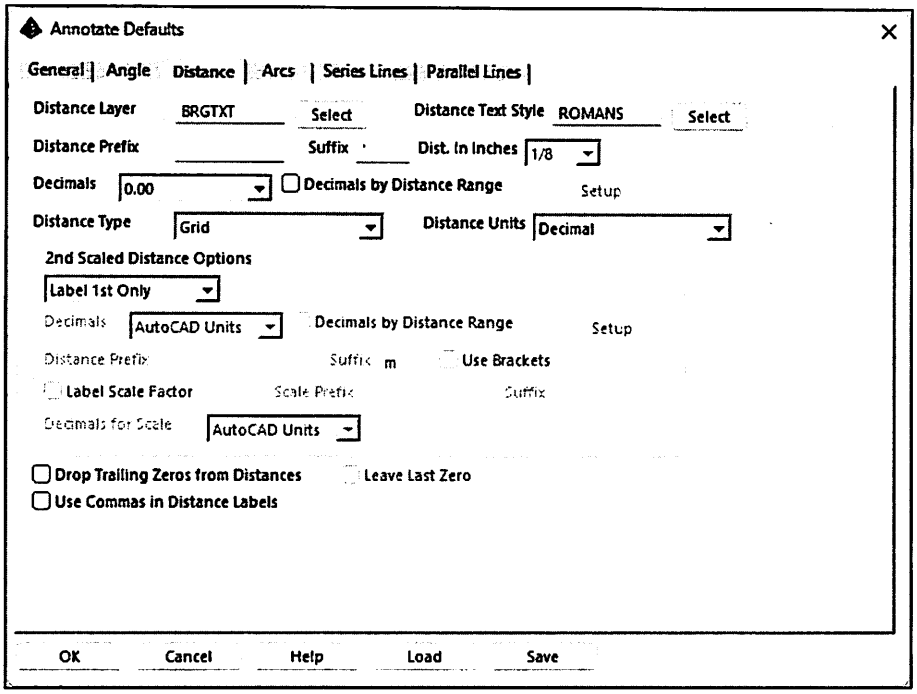


3. Confirm the **Text Size Scaler** is set to **0.08**.

The *Text Size Scaler* is the size you want to text to plot on paper, in inches for English (Imperial) drawings, in centimeters for Metric drawings.

4. Enable the option to **Use MText**.

5. Select the **Distance** tab.



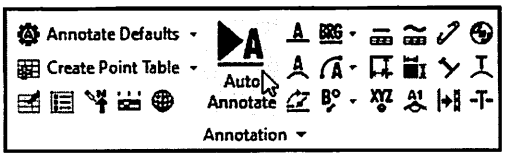
6. Set the **Decimals** to **0.00**.

7. Click **<<OK>>**.

6.2.3 Auto Annotate

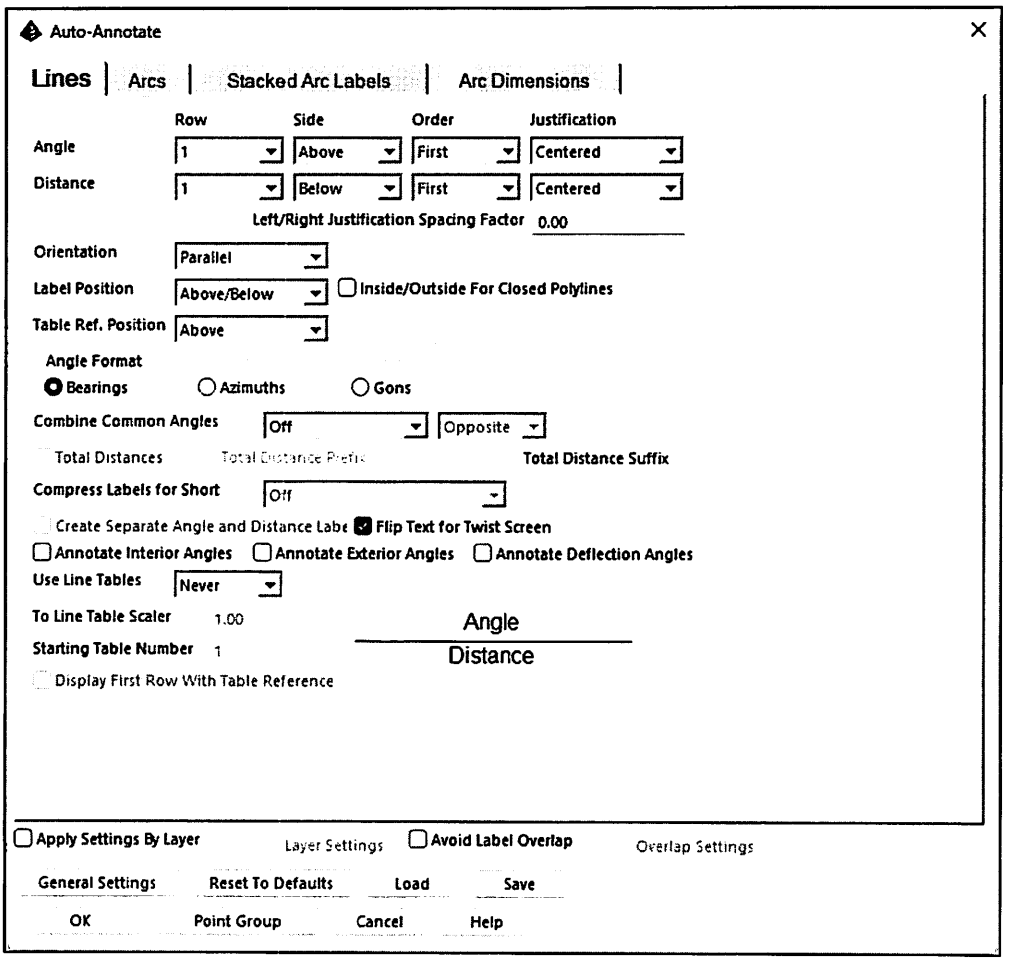
1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Annotation ⇒ Annotation ⇒ Auto Annotate.**



Alternatively, from the pull-down menu:
Select **Annotate ⇒ Auto Annotate.**

The *Auto-Annotate* dialog box is opened.



3. Select the **Lines** tab.

4. Confirm the **Angle** variables are set to **Row 1, Side Above.**

5. Confirm the **Distance** variables are set to **Row 1, Side Below.**

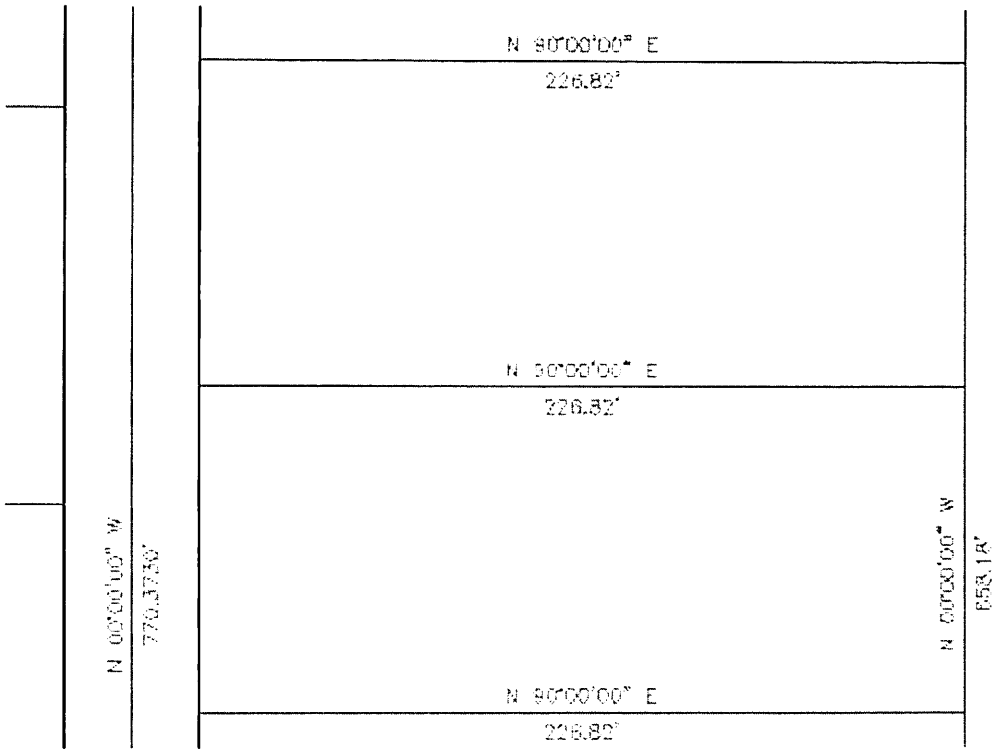
6. Confirm the **Angle Format** is set to **Bearings.**

Notice the preview at the bottom of the dialog box. It shows the line label with the angle on top of the line and the distance below.

7. Click **<<OK>>.**

8. Select the proposed lot lines. Press **Enter.**

The lines are labeled according to the settings specified.



9. Grip edit one of the lines you labeled to change the length and bearing of the line.

10. Notice the labels update to match the new geometry.

If you disable the *Link Labels to Linework* option in the *General Settings* dialog box, when you label lines with this same command the labels will not update when the lines are edited.

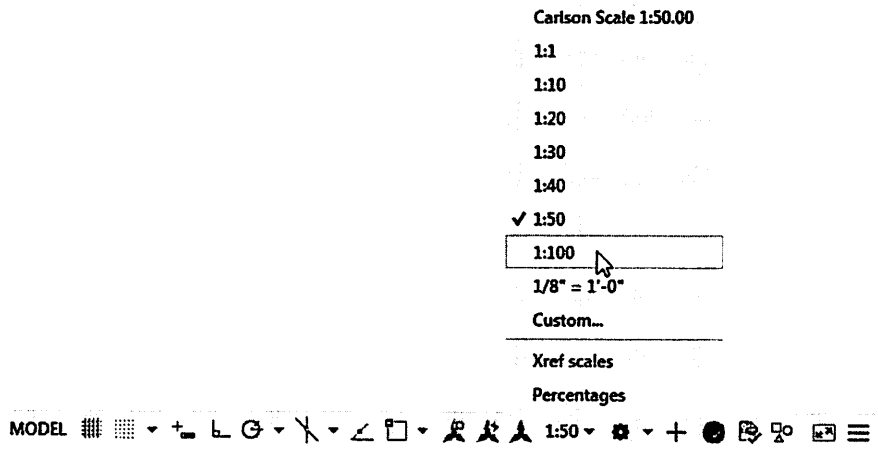
Lesson Review

In this lesson, you learned how to perform simple labeling for linework in a drawing. First you visited the option to link labels with linework to make them dynamic, that is to say, to automatically update as the geometry of the linework that is labeled is edited. You then reviewed the *Annotation Default* settings, and finally, used *Auto Annotate* to create labels. You then edited the linework and saw the labels change.

6.3 Lesson: Annotative Text and Points

Introduction

An alternative to creating text styles for each drawing scale is to use Annotative Text. Annotative text is placed in the drawing once and automatically changes height with the drawing scale. This is particularly usefully and actually designed for use in Paper Space. Paper Space allows you to set up Layout Tabs, each one having the capability of its' own unique drawing scale. For example: a drawing is created at 1"=50' but in a particular area you would like a detail drawn at 1"=10'. Annotative Text will allow you to print both drawing scales with the same text without rescaling.



Key Concepts

Concepts and key terms covered in this lesson are:

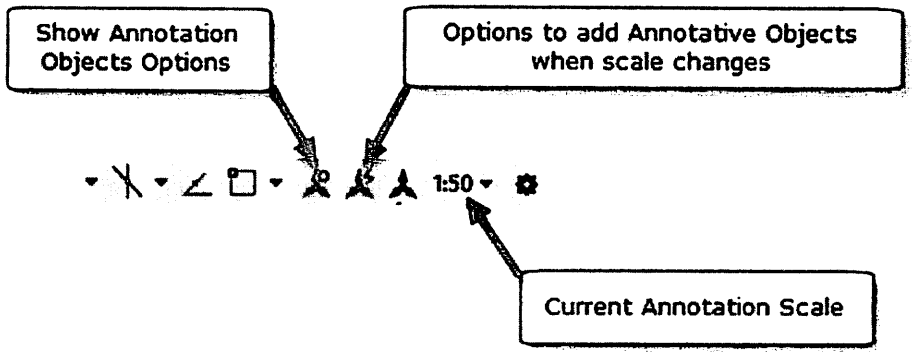
- Setting the Annotative Text option
- Setting the Annotative Points option
- Understanding Annotative Scales

Objectives

After completing this lesson, you will be able to:

- Set labeling and points to Annotative
- Set Annotative Scales
- Understand the advantages of Annotative Scales

Annotation Scale



At the lower right position of your drawing displayed in a customizable options toolbar are the settings for the Annotation Scale.

The **Show Annotation Objects** option allows you control whether or not all objects for all scales will be displayed or not.

The option to **Add Annotative Objects when the scale changes** controls whether or not all objects will automatically be generated at the new scale whenever the current scale is changed.

The option to **Show Annotative Objects** controls whether or not objects will be shown for the current scale

The **Current Annotative Scale** displays the current scale. It also contains a drop down box to select a new scale.

Exercises: Using Annotative Text and Points

In these exercises you will set up a drawing for use with annotative text and points and observe what happens when the annotative scale of the drawing is changed.

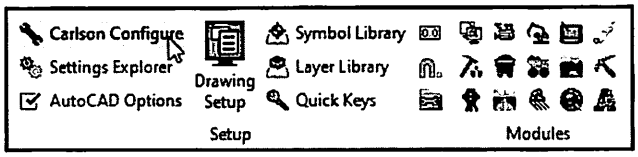
You do the following:

- Set annotative text option
- Set Annotative Points option
- Annotate lines and arcs
- Change annotative scales

6.3.1 Setting up Annotative Text and Points

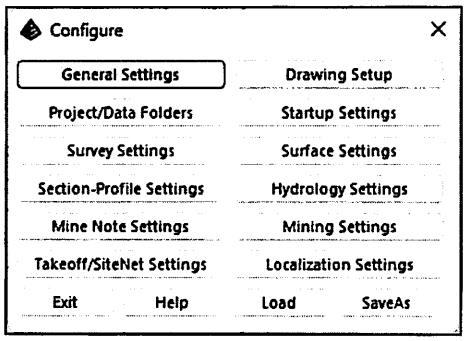
1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_3\DWGS\6_3.dwg**

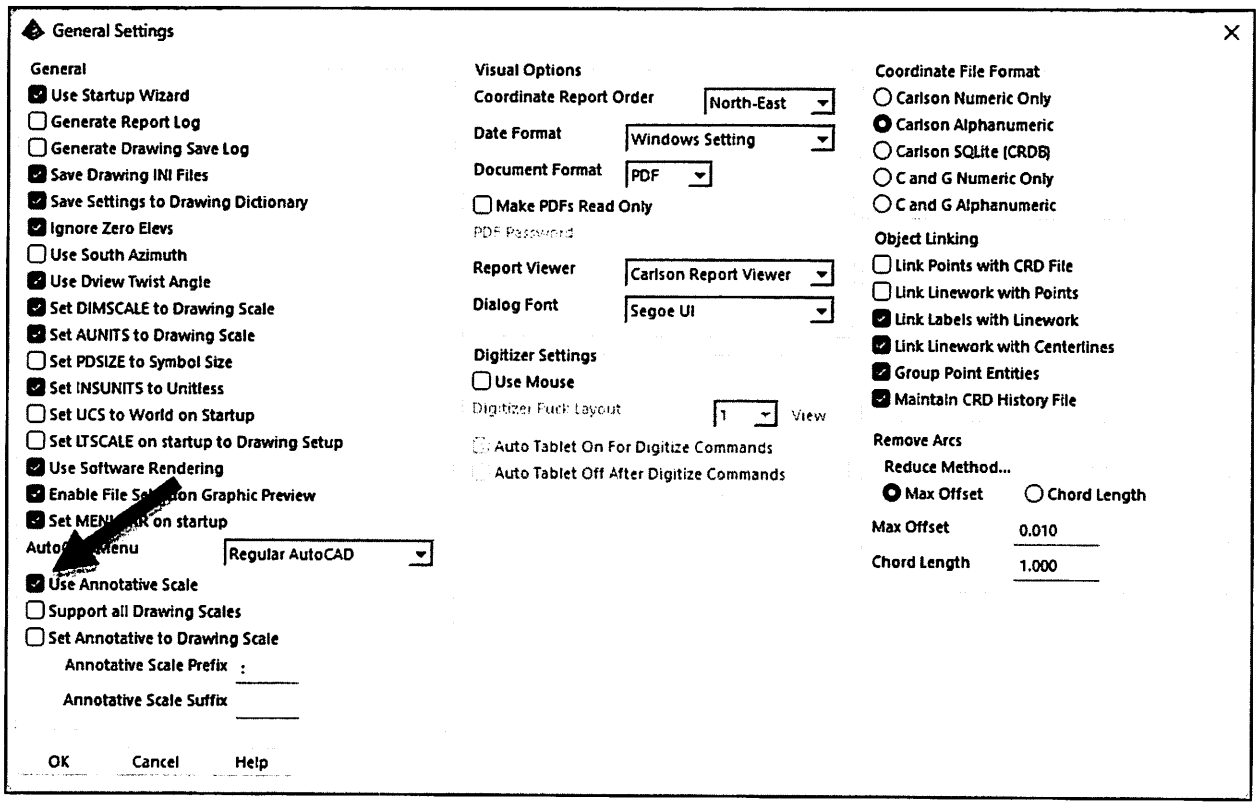
2. Select **Ribbon: Setup ⇒ Setup ⇒ Carlson Configure.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Carlson Configure.**

3. From the Carlson Configure dialog box click **<<General Settings>>.**



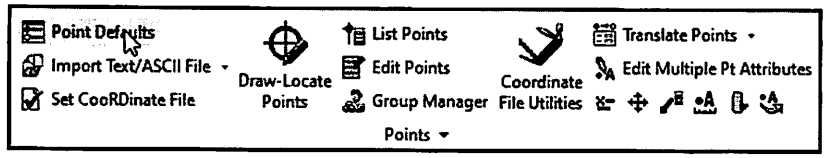


4. Enable the **Use Annotative Scale** option.

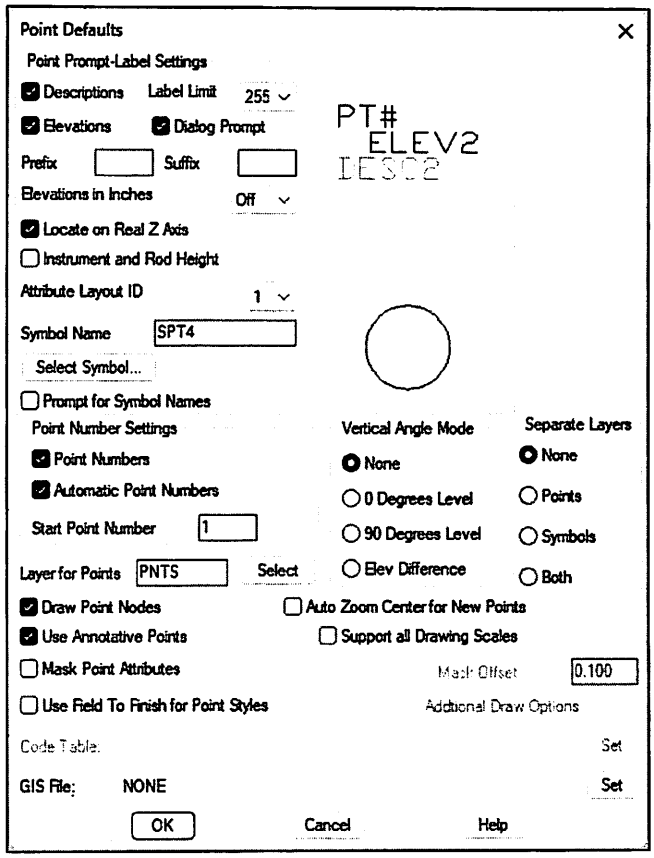
5. Click **<<OK>>.**

6. Back in the *Configure* dialog box, click **<<Exit >>.**

7. Select **Ribbon: ⇒ Points ⇒ Point Defaults.**



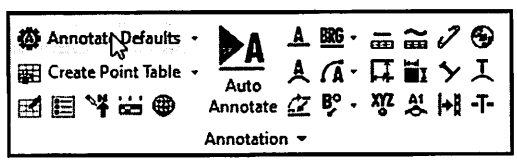
Alternatively, from the pull-down menu select: **Points ⇒ Point Defaults.**



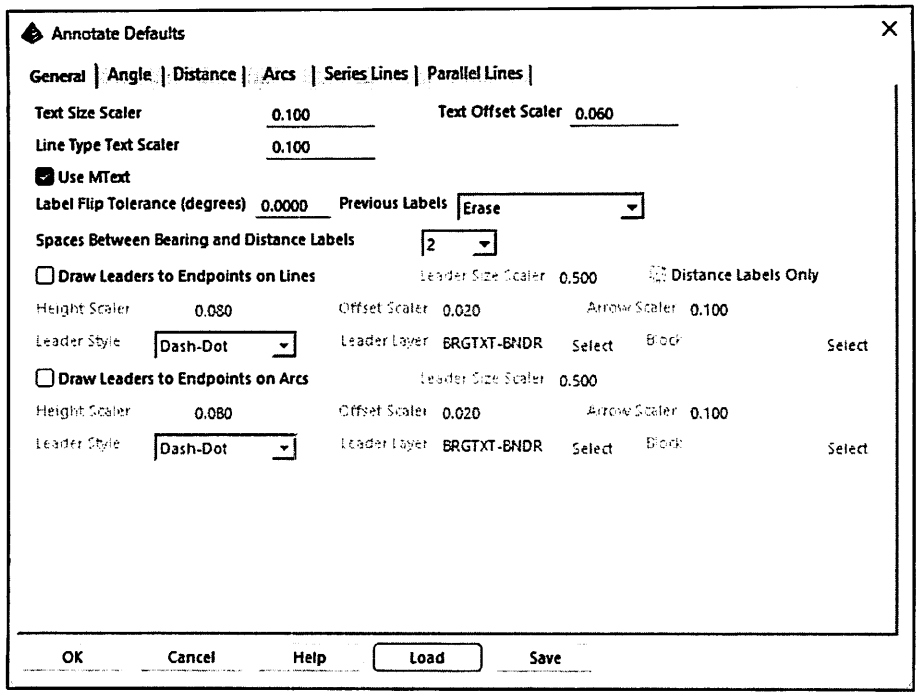
8. **Enable** the **Use Annotative Points** option.

9. Click **<<OK>>.**

10. Select **Ribbon: Annotation ⇒ Annotation ⇒ Annotate Defaults**



Alternatively, from the pull-down menu select: **Annotate ⇒ Annotate Defaults**



11. On the *General* tab, **enable** the **Use MText** option.

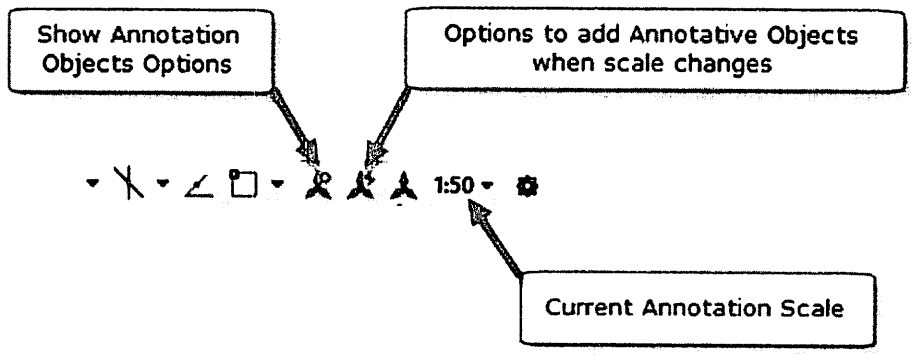
Using MText as opposed to Standard text controls the spacing between lines when changing scales in the drawing

12. Click **<<Load>>**.

13. Select the file **C:\Carlson Projects\APG 2023 Data\ Basic CAD Drawing\Boundary.ADF** and click **<<Open>>.**

The *.ADF* file contains a saved group of settings for the *Annotate Defaults* dialog box. This is a great way to automate and streamline your drafting standards.

14. Click **<<OK>>.**



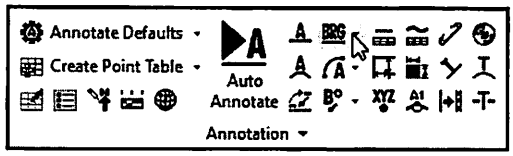
15. Set the Show Annotation Objects to **Always.**

16. Set the Add Annotative Scales to Objects to **ON.**

17. Ensure the Current Scale is set to **1:50.**

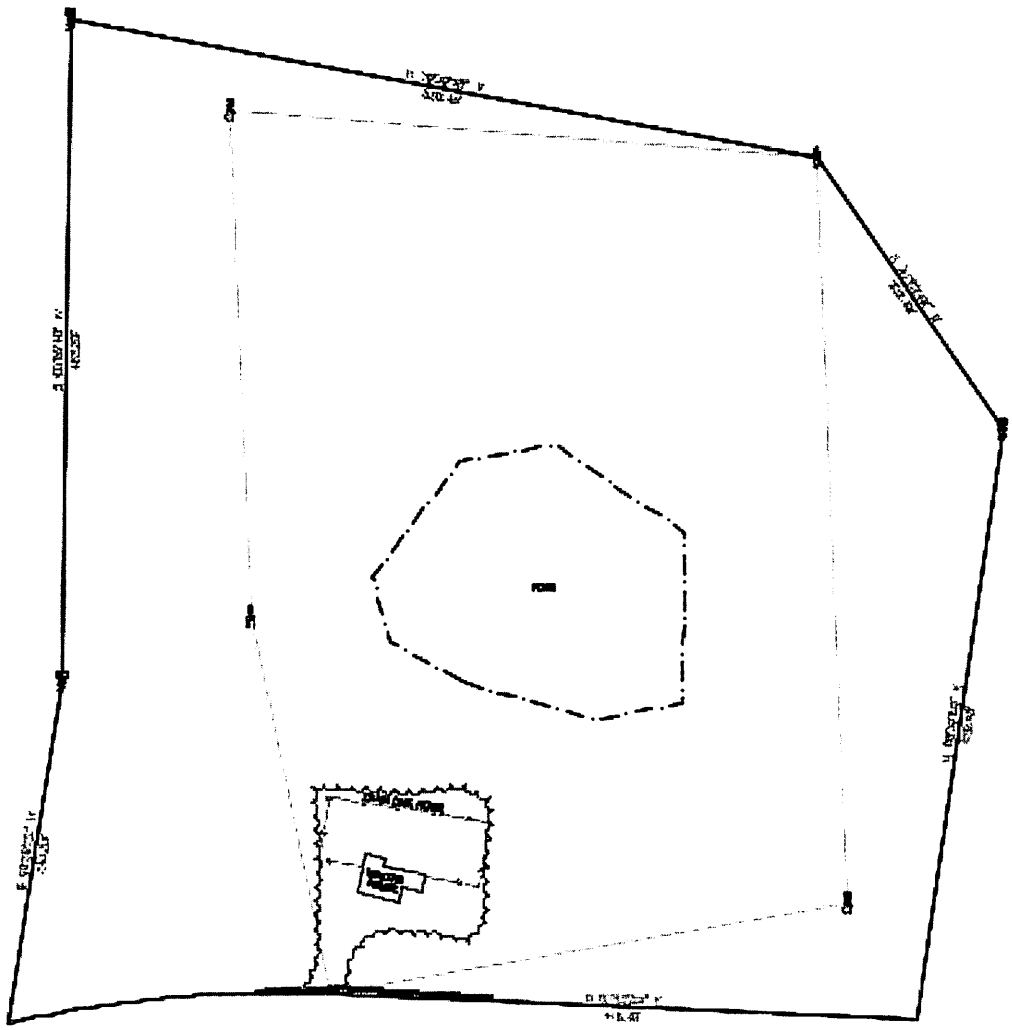
6.3.2 Annotate the Plan

1. Select **Ribbon: Annotation ⇒ Annotation ⇒ Bearing _Distance**

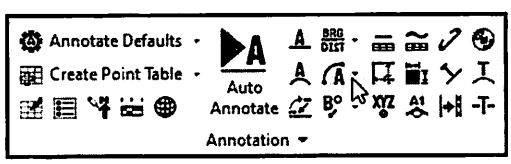


Alternatively, from the pull-down menu
select: **Annotate ⇒ Angle/Distance ⇒ Bearing _Distance**

2. Label the Boundary Line using the Bearing over distance option by picking each segment.



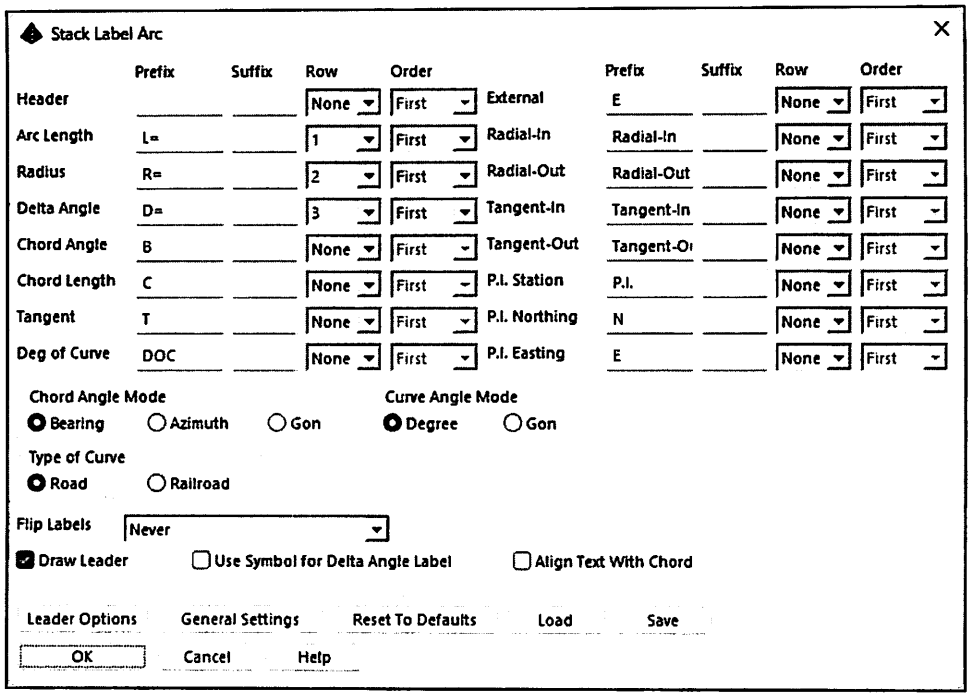
3. Select **Ribbon: Annotation ⇒ Annotation ⇒ Stack Label Arc.**



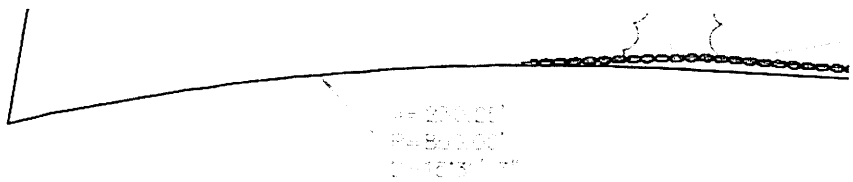
Alternatively, from the pull-down menu
select: **Annotate ⇒ Annotate Arc ⇒ Stack Label Arc.**

4. At the prompt *Options/Points/<Select arc>:* Enter **O** for options.

If this is the first time you have used this command you will be automatically taken to the options.



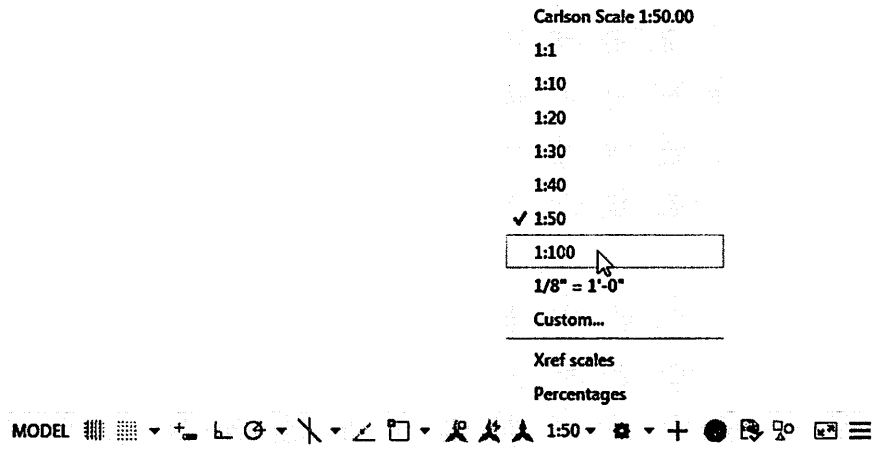
5. Set the Arc Length to: **L=** Sequence=**1**
6. Set the Radius to: **R=** Sequence =**2**
7. Set the Delta Angle to: **D=** Sequence =**3**
8. Set remaining curve labels to **None.**
9. Click **<<OK>>.**
10. At the prompt *Options/Points/<Select arc> (Enter to end):* Select the Arc Segment at the lower left of the property boundary.
11. *Pick end point for leader:* Select the location of the Annotation Label.
12. Options/Points/<Select arc> (Enter to end): press **[Enter]** to end the command.



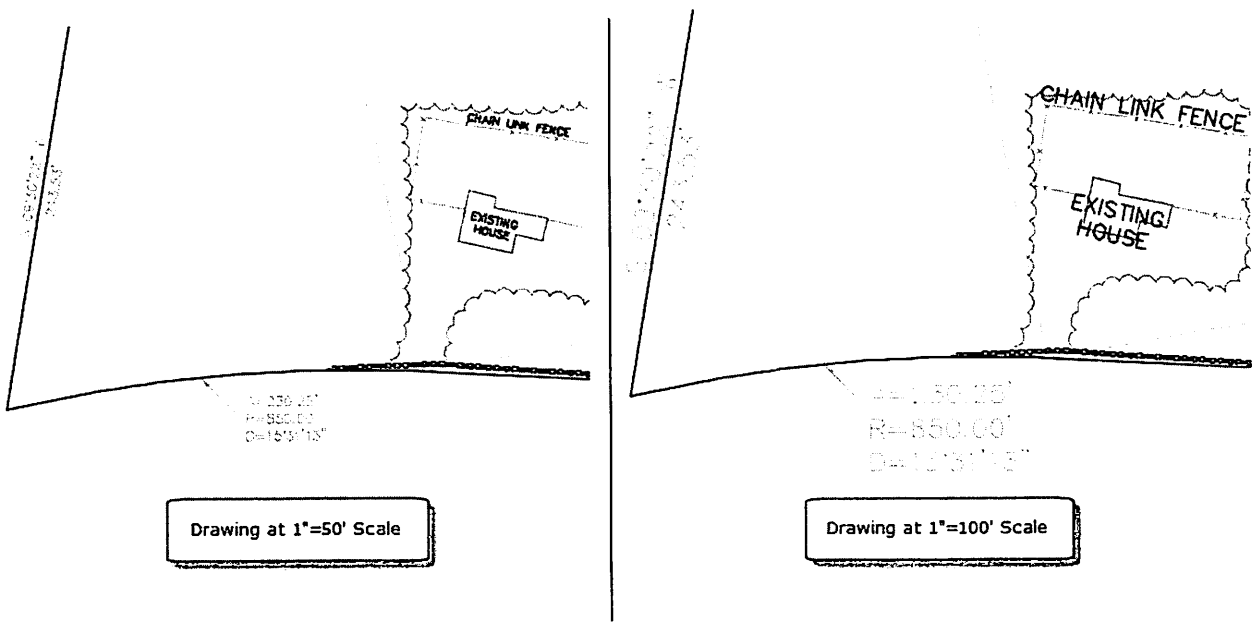
6.3.3 Change the Annotative Scale

1. Click the Current Annotative Scale list and select the scale **1:100.**

In *IntelliCAD* you need to double click on the scale to bring up the scale list.



Notice the change in the text size. Since this drawing was created using Annotative Points, the symbols and associated attributes changed as well. It is also important to note that the text from each individual scale can be moved or rotated independent of the other, allowing you complete flexibility in the appearance of the plan.



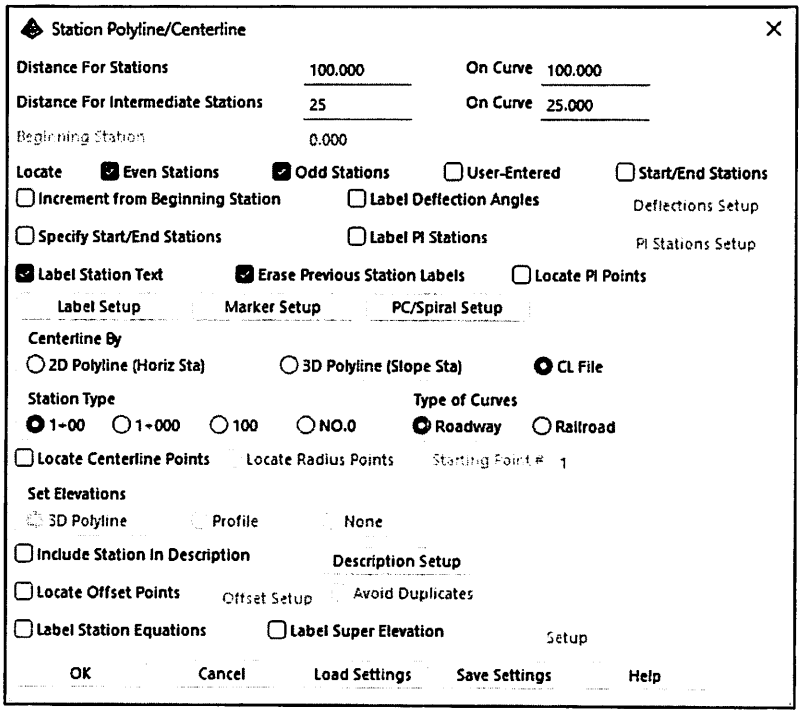
Lesson Review

In this lesson you learned about Annotative objects and scales. This may take a bit of getting used to if it is your first time using this feature but once you get used to it, it will save you a great deal of time when changing scales in a drawing. It is particularly useful when using paper space and creating detailed areas within a plan set.

6.4 Lesson: Working with Centerlines

Introduction

Many *Carlson Software* applications have the ability to work with 2D alignments, known as centerlines in the software. They can be defined from polylines, edited, and stored externally as .CL files. They can be stationed in the drawing, and exported in a variety of proprietary data types.



Key Concepts

Concepts and key terms covered in this lesson are:

- Centerlines
- Centerline Editor
- Centerline Stationing

Objectives

After completing this lesson, you will be able to:

- Utilize the Centerline functions in Carlson Software

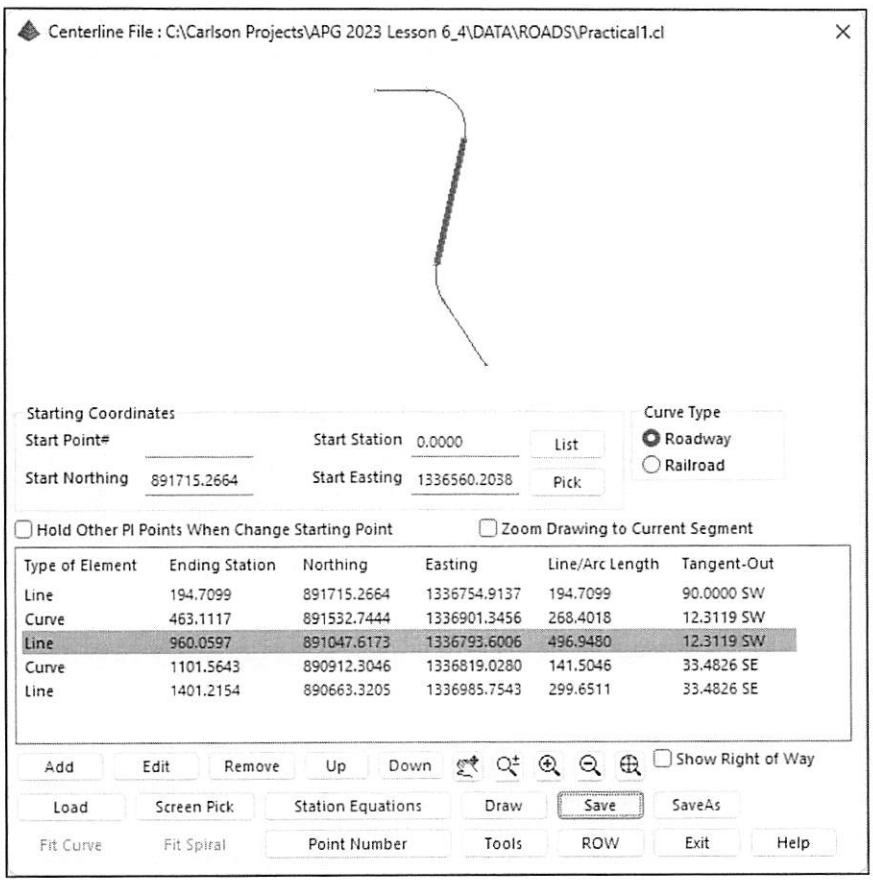
Creating a Centerline

There are three different methods of creating a centerline in Carlson Software:

- Input-Edit Centerline File
- Polyline to Centerline File
- Design Centerline

Input-Edit Centerline File

This command is a dialog box based command that allows you to create and edit a *Centerline File* by entering a variety of centerline data like coordinates, stationing, or length of lines or arcs to define a centerline, and/or edit any centerline data to change its geometry.

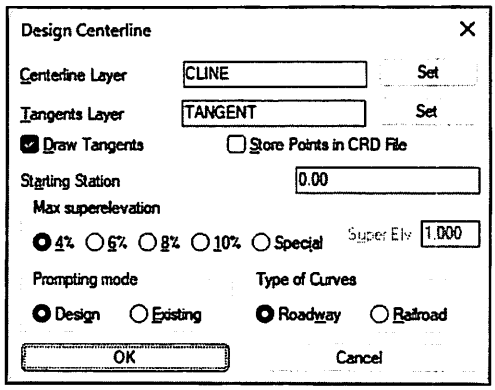


Polyline to Centerline File

This command allows you to use an existing polyline to define an external .CL *Centerline File.*

Design Centerline

The Design Centerline command guides you through a series of command line prompts that take you through a process of providing coordinates, defining lines with bearings and distances, and curve data as necessary to describe the geometry of the centerline. A polyline is drawn as you go, and the geometry is written to an external .CL *Centerline File*.



Exercises: Define a Centerline, Edit it, Station it, and Export it

In these exercises you draw a polyline, define it as a Carlson external .CL file, Edit it in the Centerline Editor, Station the Centerline, and learn options to Export it to a variety of formats.

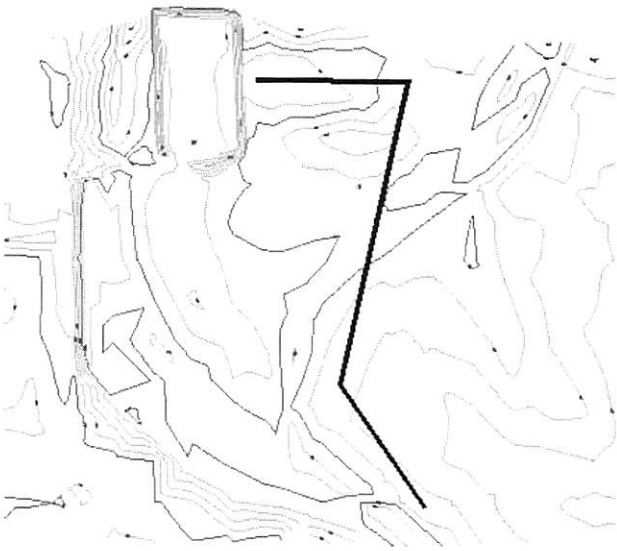
You do the following:

- Draw a Polyline
- Define it as a Centerline
- Edit the Centerline
- Station the Centerline
- Export the Centerline

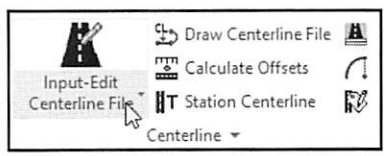
6.4.1 Define a Centerline

1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_4\DWGS\6_4.dwg**

2. Draw a polyline within the surface area using four vertices, creating three segments, similar to the graphic below.



3. Select **Ribbon: Centerline ⇒ Centerline ⇒ Input-Edit Centerline File ⇒ Polyline to Centerline File.**



Alternatively, from the pull-down menu:
Select **Centerline ⇒ Polyline to Centerline File.**

4. In the *Centerline File to Write* dialog box enter a name of **Practical1.cl**.

5. Click **<<Save>>**.

6. When prompted at the command line, pick the polyline you just drew.

7. Press **Enter** to accept the default starting station of **0+00**.

8. Press the **F2** key to see the stations and coordinates of the PI's.

```
Station    North(y)     East(x)      Description
-----------------------------------------------------------
0.000      891717.640   1336590.077  LI
398.139    891713.501   1336988.195  LI
1144.257   890993.292   1336793.283  LI
1587.652   890632.100   1337050.459  LI
```

Your coordinates will not match exactly since you did not enter specific values when drawing the polyline.

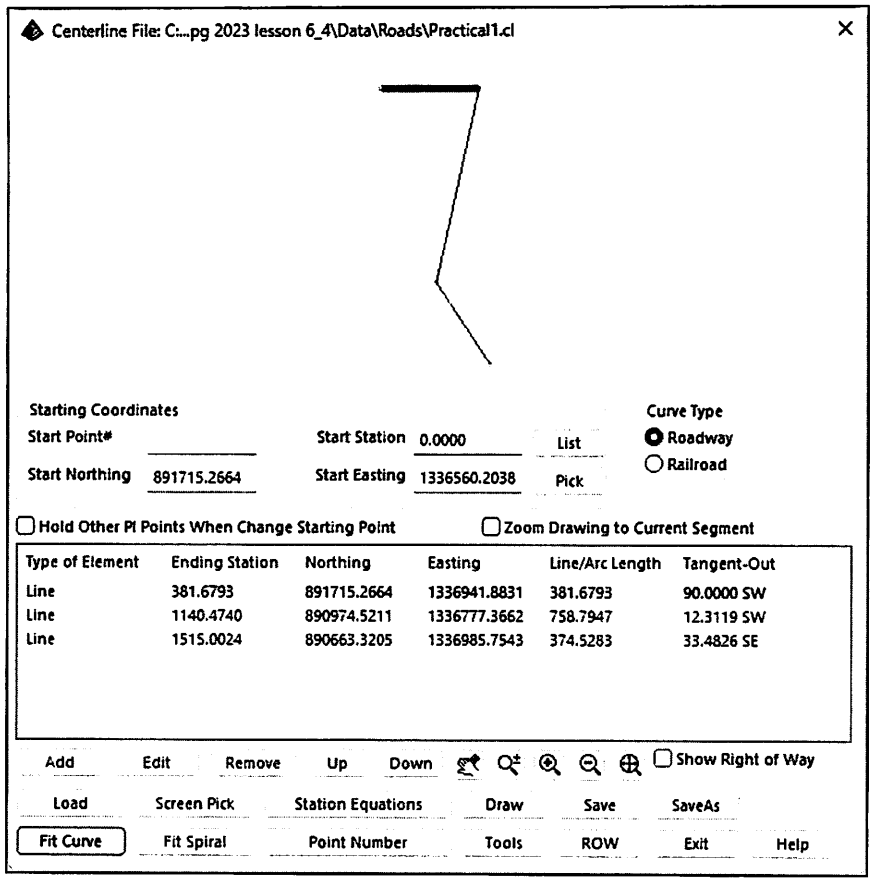
9. **Enter** to end the command.

6.4.2 Edit a Centerline

1. Continue working in the drawing from the previous exercise.
2. Double-click on the polyline representing the centerline.

Carlson Software knows that this polyline is linked to an external centerline .CL file, and opens the Edit Centerline dialog box.

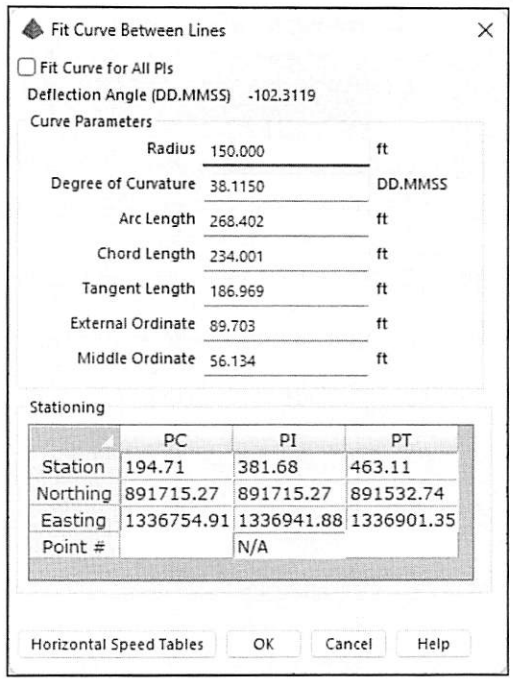
3. In the Centerline Editor, pick the first line listed. It is highlighted in the graphic screen.
4. Click **<<Fit Curve>>**.



5. Enter a Radius of **150**.

6. Pick in any other field to solve the rest of the geometry for the curve.

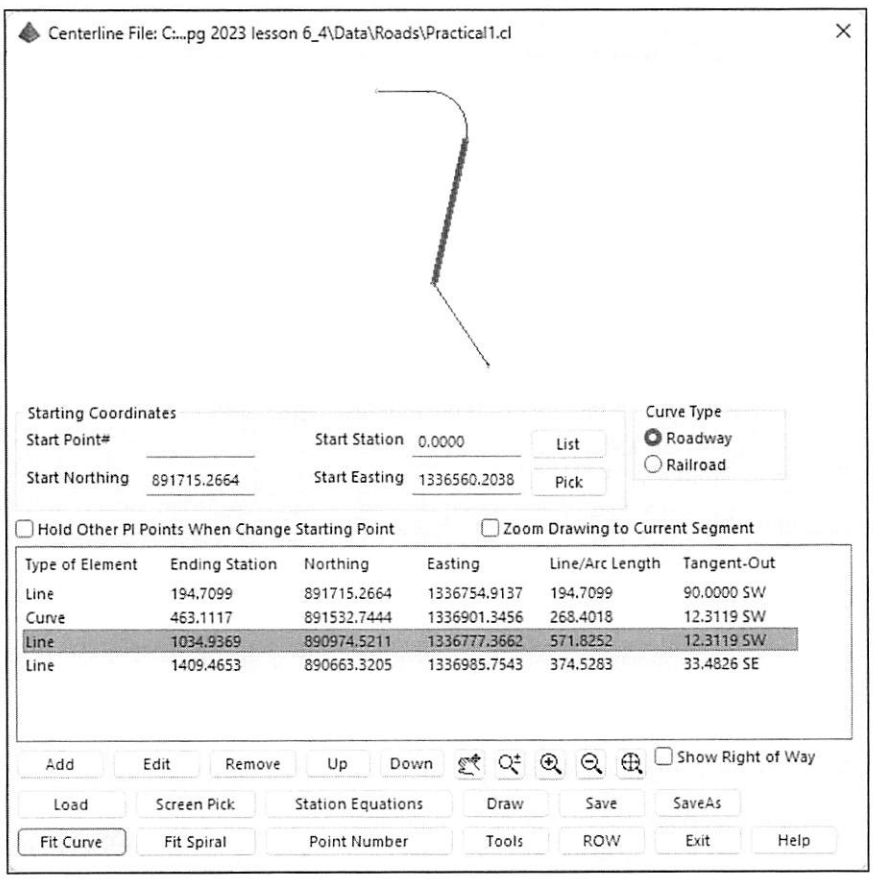
7. Click **<<OK>>**.



The curve is added to the centerline and the preview image is updated.

8. Pick the second line element in the table.

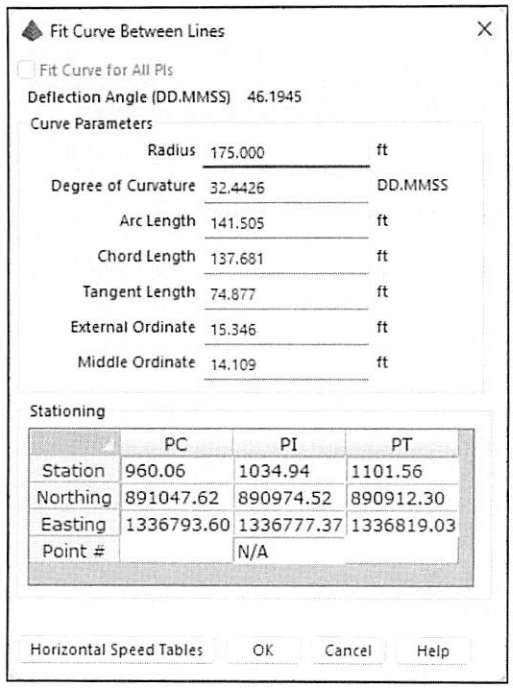
9. Click **<<Fit Curve>>**.



10. Enter Curve Radius of **175**.

11. Pick in any other field to solve the rest of the geometry for the curve.

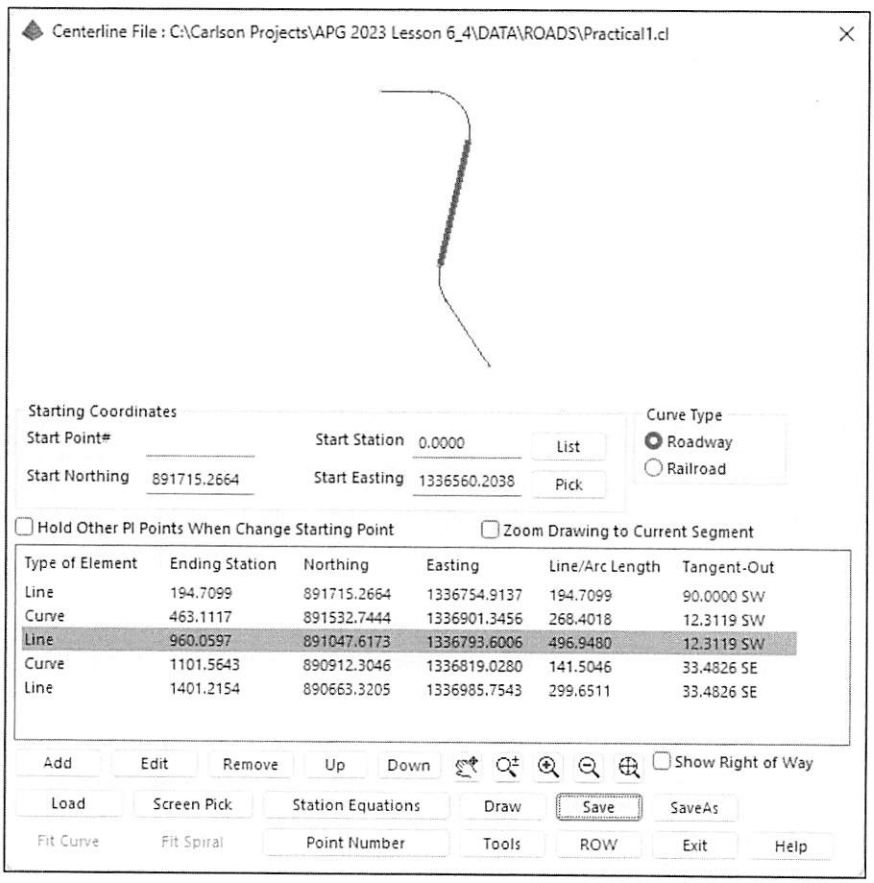
12. Click **<<OK>>**.



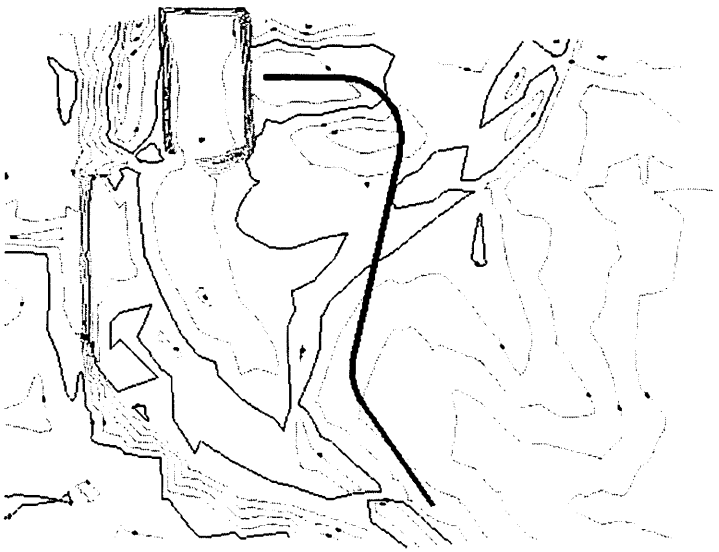
13. Again the centerline is recalculated and the preview is updated.

14. Click **<<Save>>**.

15. Click **<<Exit>>**.



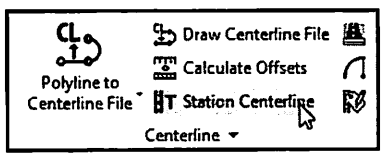
The edited centerline is redrawn in the drawing.



6.4.3 Station a Centerline

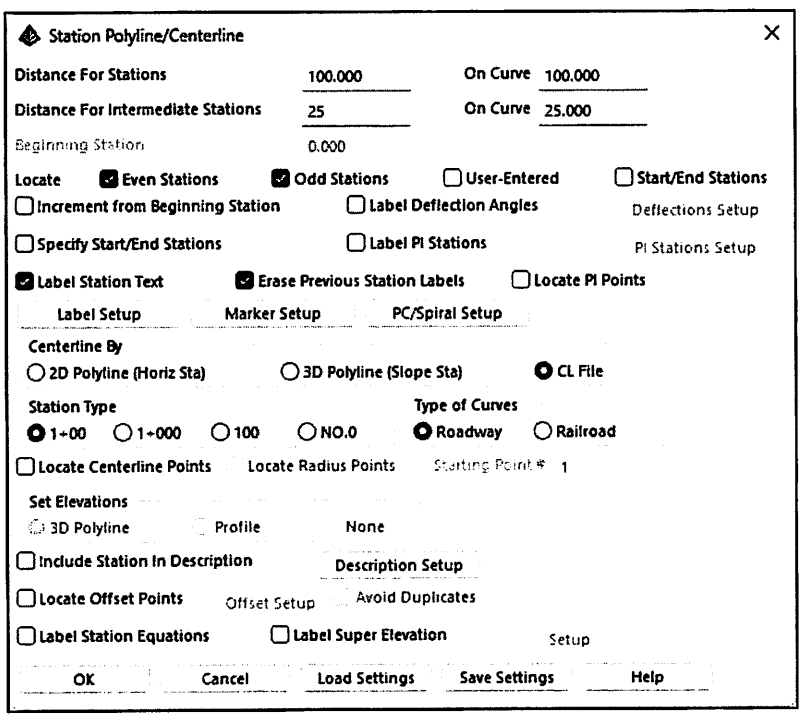
1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Centerline ⇒ Centerline ⇒ Station Centerline.**



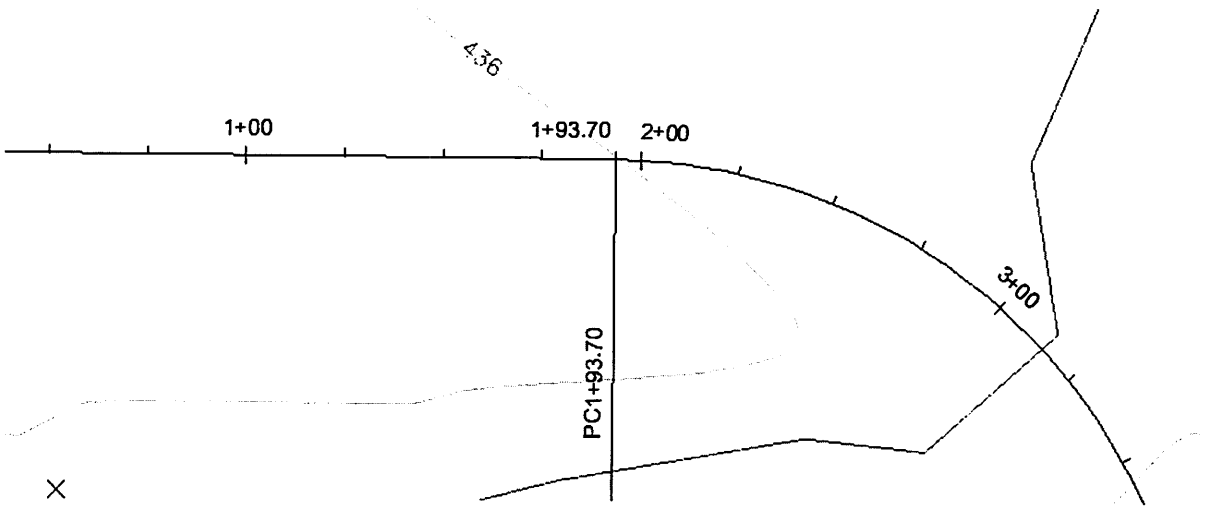
Alternatively, from the pull-down menu:
Select **Centerline ⇒ Station Polyline/Centerline.**

The *Station Polyline/Centerline* dialog box opens.



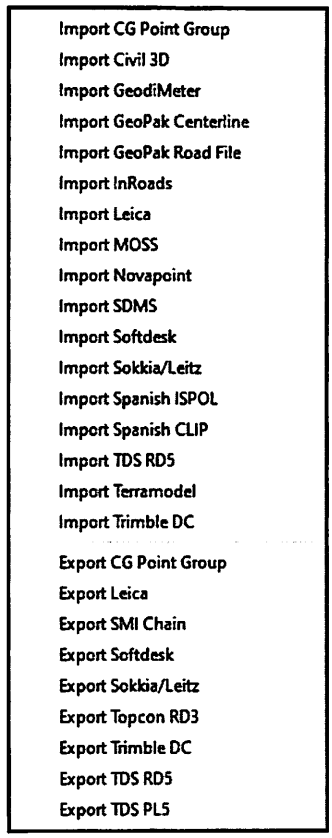
3. Confirm the **Distance For Stations** is set to **100**.
4. Set the **Distance For Intermediate Stations** to **25**.
5. Confirm the **Locate** options for **Even Stations** and **Odd Stations** are enabled.
6. Confirm the **Label Station Text** option is enabled.
7. Set the **Centerline By** option to **CL File**.
8. Click **<<OK>>**.
9. Select the **Practical1.CL** file that you created earlier in this lesson.
10. Click **<<Open>>**.

The centerline is stationed according to the settings selected.



6.4.4 Export a Centerline

1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu:
   Select **Centerline ⇒ Centerline Conversion ⇒ .**
3. Select one of the *Export* file formats.



Some of the export formats require a profile for vertical information before they can be exported.

4. In the *Choose Centerline File to Read* dialog box, select the **Practical1.cl** file.
5. Click **<<Open>>**.
6. In the *Choose File to Write* dialog box, enter a name for the new file to be created.
7. Click **<<Save>>**.

The new file is created and ready to use in the format specified.

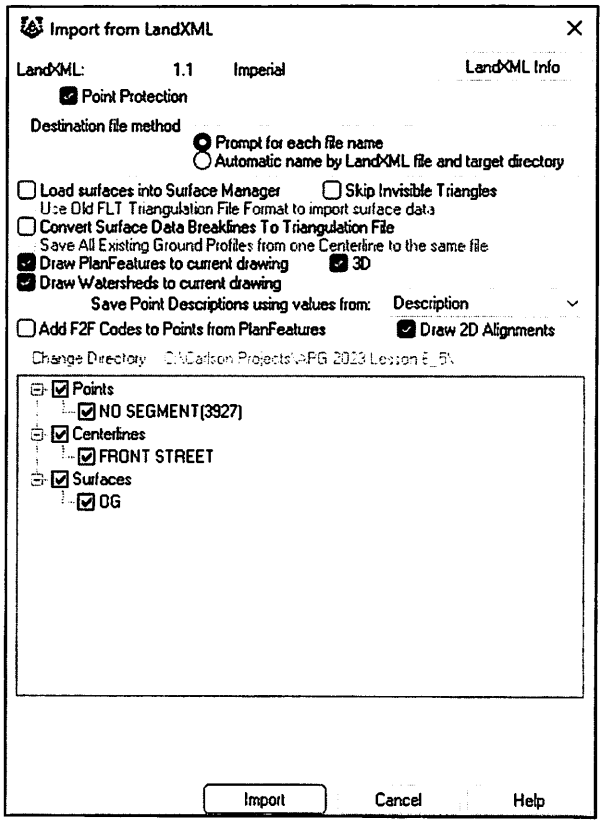
Lesson Review

In this lesson you learned how to Define Centerlines, Edit Centerlines, Station Centerlines, and Export Centerline data in *Carlson Software*.

6.5 Lesson: LandXML Export/Import

Introduction

LandXML is a universal file format used to store and transfer civil/survey data. Data types supported include points, surfaces, alignments, profiles, cross-sections, and parcels. *Carlson Software* fully supports the export and import of LandXML files.



Key Concepts

Concepts and key terms covered in this lesson are:

- LandXML Export
- LandXML Import

Objectives

After completing this lesson, you will be able to:

- Utilize LandXML Export to write project data to a universal file format
- Utilize LandXML Import to read a LandXML file to recreate civil/survey data in Carlson Software

LandXML

As mentioned in the introduction of this lesson, LandXML is a universal format for civil/survey data, including:

- Points
- Centerlines
- Profiles
- Cross Sections
- Lots
- Surfaces
- Sewer Networks

The implementation of LandXML in standard workflows provides a simple and versatile method to exchange your work with other professionals utilizing other software solutions. This is clearly the primary use of this technology. However the use of LandXML also provides two other significant benefits.

First, it is an excellent way to archive your work. While a variety of data files are used with Carlson as you are performing various tasks in the software, all of the data types listed above, as well as multiple incidences of each of them, can all be stored in a single LandXML file for archiving purposes. And as future software versions are developed, the theory is that they will all be able to still read any version of a LandXML file.

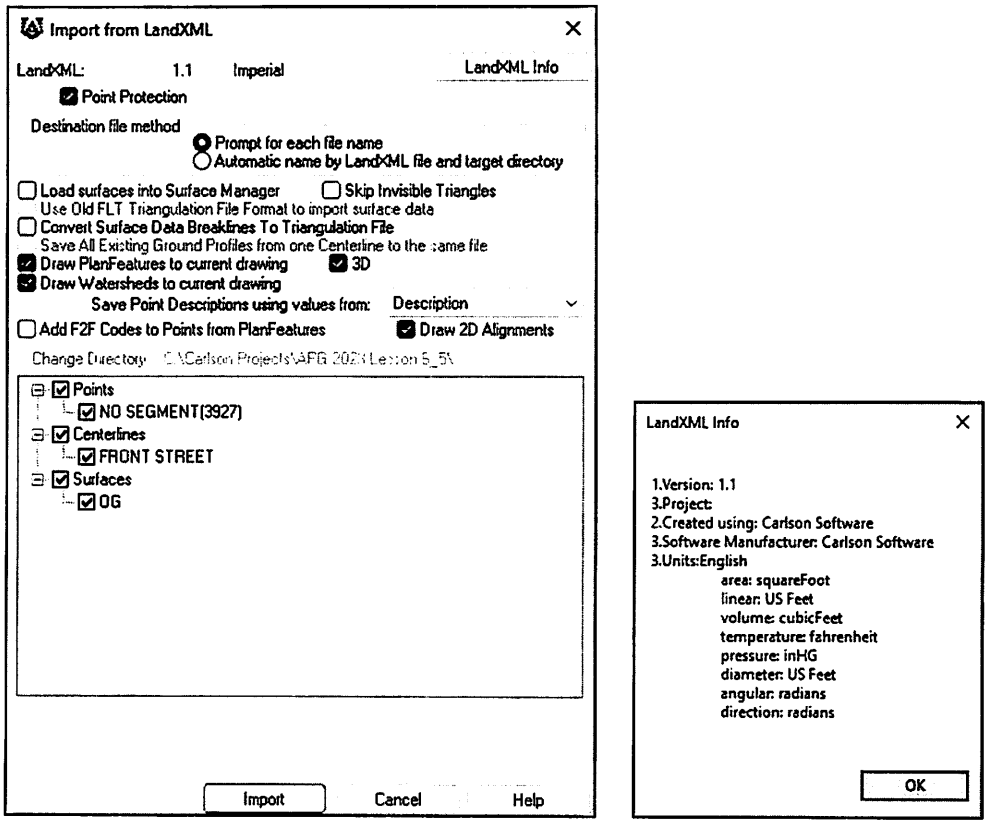
Second, the use of LandXML Export and Import is an excellent way, and in fact in some cases, the only way, to convert a project dataset from Imperial Units to Metric, or vice versa. LandXML knows what units the file is created in, and if the drawing that a LandXML file is Imported into is set to different units, the Import function will convert the data on the fly.

LandXML 2.0

Carlson supports LandXML 2.0. Visit LandXML.org to learn more about the capabilities of the new version.

Importing LandXML Data

When Importing a LandXML file into Carlson Software, there are a number of options available.



At the top of the *Import from LandXML* dialog box, the Units of the LandXML file are listed. The *<<LandXML Info>>* button invokes a report of information about the file, the metadata.

If *Point Protection* is selected, and point data is being Imported, if the same point numbers being Imported already exist in the destination .CRD coordinate file, you are prompted and must choose how to resolve the conflicts.

The newly created files can be automatically named during the Import, or you can be prompted to supply a name for each one as it comes in. Choosing Automatic Naming enables the Change Directory button so you can specify a path for all the files generated by the Import.

All of the types of data present in the LandXML file are listed in the dialog box, along with the specific occurrences of each. You can select or unselect whole categories, and/or specific instances for the Import.

Exercises: LandXML Export and Import

In these exercises you Export civil/survey data to LandXML, and then Import LandXML data into Carlson Software.

You do the following:

- Export Data to LandXML
- Import LandXML Data into Carlson

6.5.1 LandXML Export

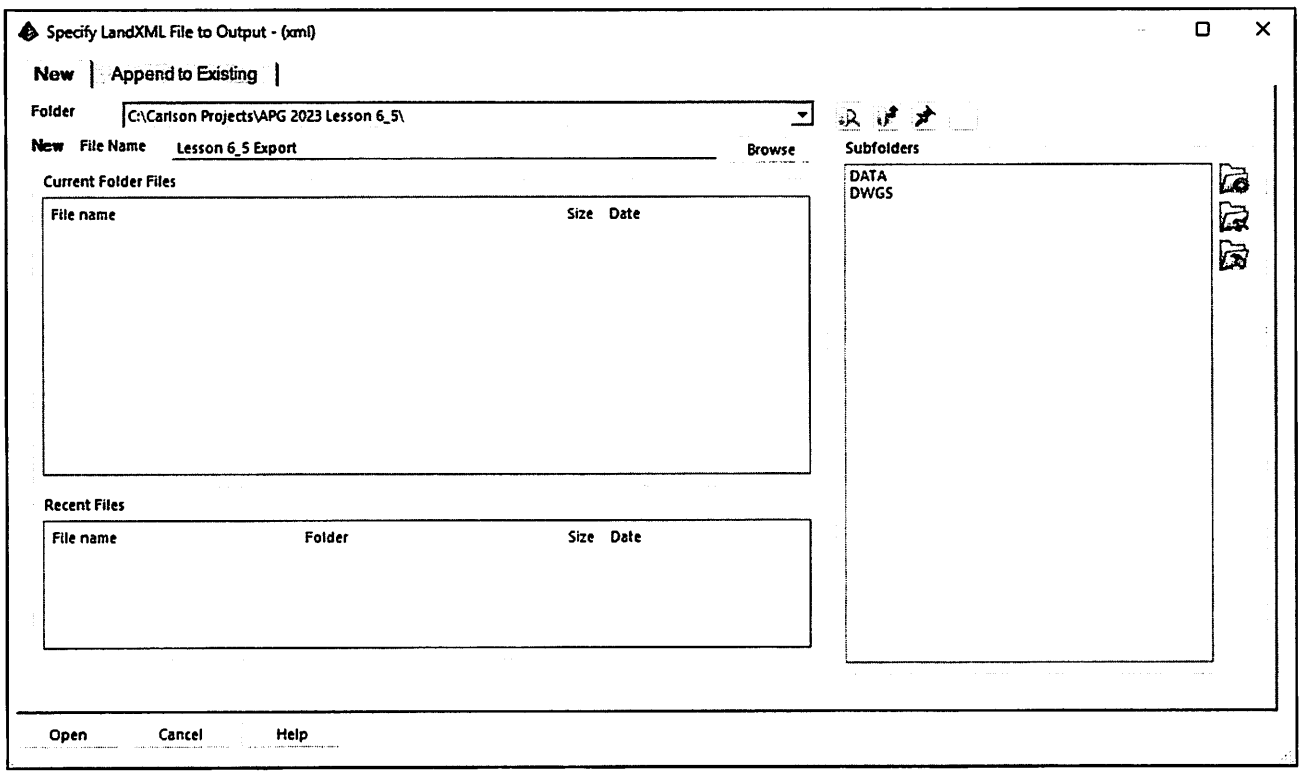
1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_5\DWGS\6_5.dwg**

This drawing has an associated coordinate file, an existing conditions surface, and a defined centerline.

2. Select **Ribbon: File ⇒ Export ⇒ Export LandXML File.**

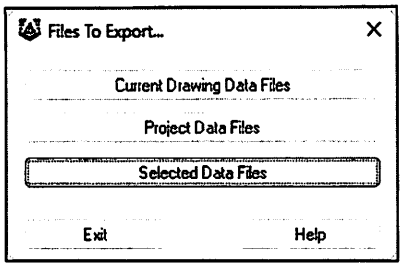
Alternatively, from the pull-down menu:
Select **File ⇒ Export ⇒ LandXML File.**

The *Specify LandXML File to Output* dialog box opens.



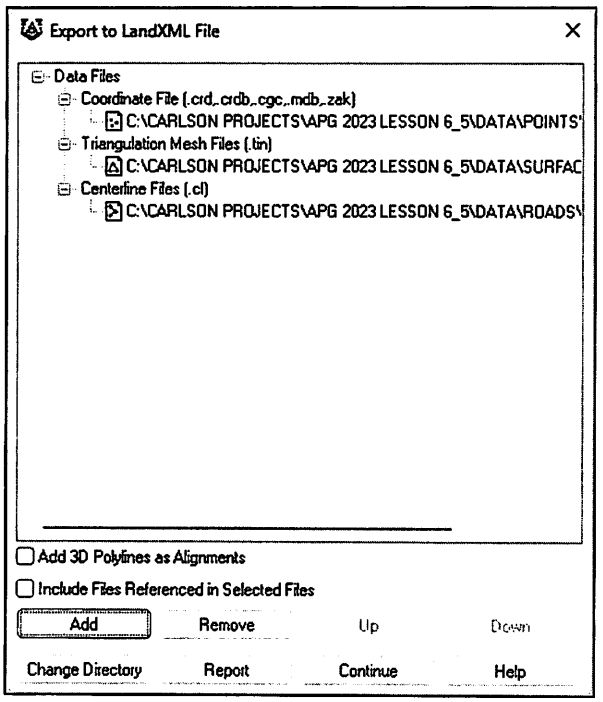
3. On the *New* tab, confirm the path is set to: **C:\Carlson Projects\APG 2023 Lesson 6_5**
4. Enter **Lesson 6_5 Export** for the **File Name** of the new .XML file.
5. Click **<<Open>>**.

6. In the *Files to Export* dialog box, click **<<Selected Data Files>>**.



The *Export to LandXML File* dialog box opens.

7. Click **<<Add>>**.
8. Browse and select: **C:\Carlson Projects\APG 2023 Lesson 6_5\Data\Points\6_5.crd**
9. Click **<<Open>>**.
10. Click **<<Add>>** again.
11. Browse and select: **C:\Carlson Projects\APG 2023 Lesson 6_5\Data\Surfaces\OG.tin**
12. Click **<<Open>>**.
13. Click **<<Add>>** again.
14. Browse and select: **C:\Carlson Projects\APG 2023 Lesson 6_5\Data\Roads\Front Street.cl**
15. Click **<<Open>>**.
16. Click **<<Continue>>**.

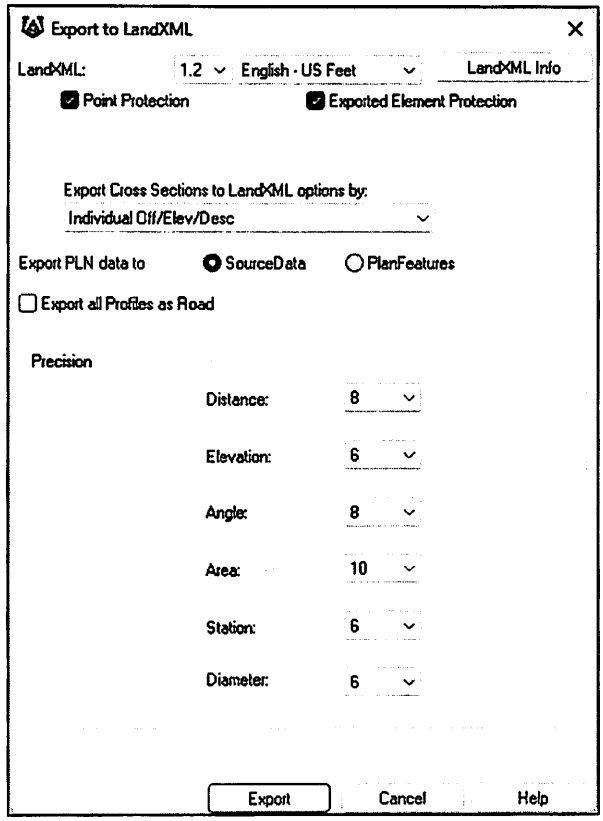


The *Export to LandXML* dialog box opens.

Here you can set the Units and Precision of the LandXML file you are creating.

17. Confirm your settings match the defaults in the graphic.

18. Click **<<Export>>**.



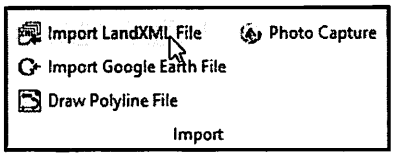
The three data files are exported to a single .XML file that can be imported into any other Civil/Survey program or data collector that supports LandXML.

6.5.2 LandXML Import

1. Create a new *Project* called **APG 2023 LandXML Import** and a new *Drawing* named **Import.**

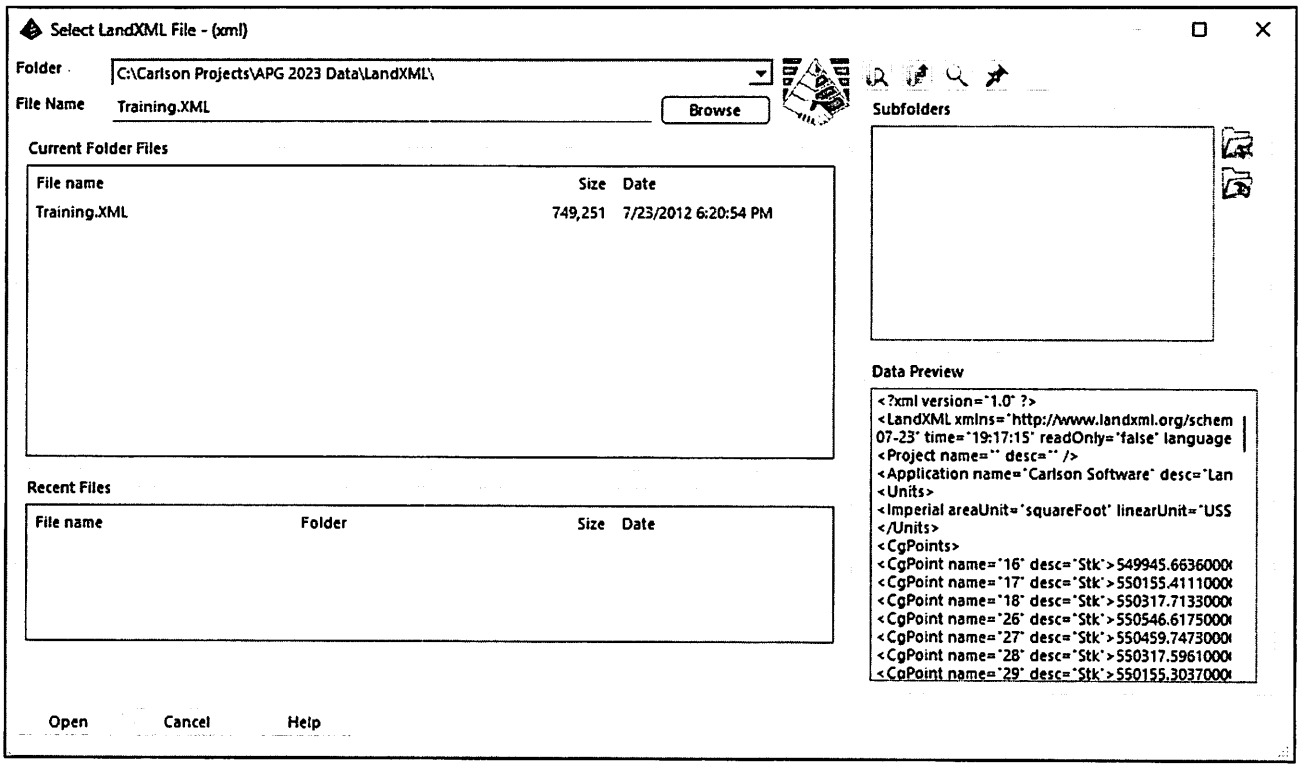
If you have questions about the process refer to *Lesson 2.3.*

2. Select **Ribbon: File ⇒ Import ⇒ Import LandXML File.**



Alternatively, from the pull-down menu:
Select **File ⇒ Import ⇒ LandXML File.**

The *Select LandXML File* dialog box opens.



3. Browse and select the file: **C:\Carlson Projects\APG 2023 Data\LandXML\Training.xml**

You can review the contents of the selected *LandXML* file in the *Data Preview* section of the dialog box.

4. Click **<<Open>>**.

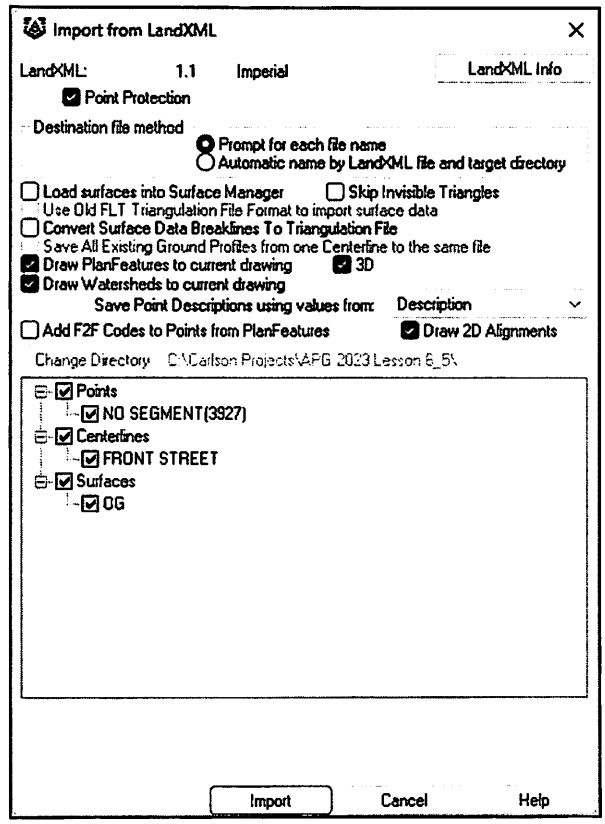
5. In the *Import from LandXML* dialog box, confirm the **Prompt for each filename** option is selected.

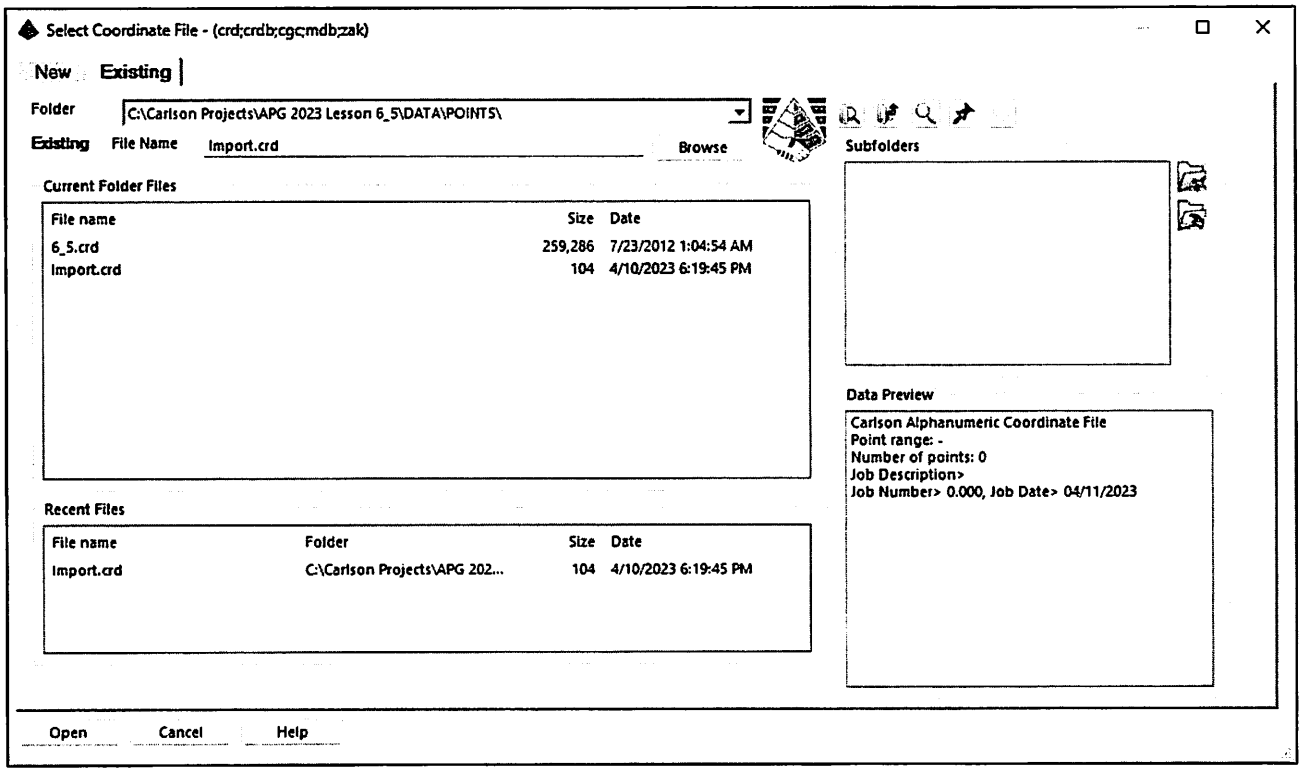
6. Confirm **Load surfaces into Surface Manager** is disabled.

7. Enable the **Draw 2D Alignments** option.

8. Confirm and all of the data files listed are enabled so you import all the Points, Centerlines, and Surfaces.

9. Click **<<Import>>**.





10. When prompted to *Select the Coordinate File* select the Existing tab and pick the new current coordinate file just created with the new project, **Import.CRD**.

11. Click **<<Open>>**.

12. When prompted for a name for the new *Triangulation File* to be created, enter **Imported_EG.TIN**.

13. Click **<<Save>>**.

14. When prompted for a name for the new *Centerline File* to be created, enter **Imported_road.cl**.

15. Click **<<Save>>**.

16. **Zoom Extents** and you will see the centerline file that has been imported was added to the drawing as a polyline.

All three data types have been successfully imported into the Carlson environment. All of these are now valid Carlson data and can be used as such.

The following steps walk you through reviewing the data that you just imported. These commands have all been used in previous lessons and step-by-step details about using those commands are listed there. Try going through these commands on your own. If you need help, refer to the previous lessons for more detail and step-by-step guidance.

17. Use **List Points** to view the points in the coordinate file.

18. Use the **Surface File Viewer** to view the surface.

19. From the pull-down menu: Select **Surface ⇒ Contour from TIN File.**

20. Select the surface **Imported_EG.TIN** you just imported and click **<<Open>>**.

21. Select the **Contour** tab.

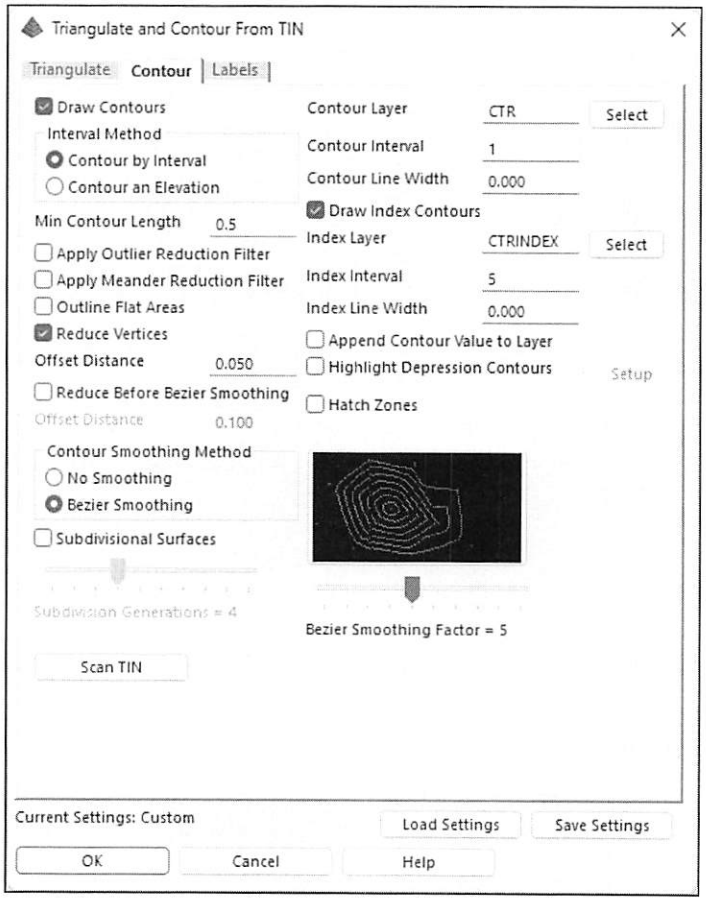
22. Enable the **Draw Contours** option.

23. Enable **Draw Index** Contours.

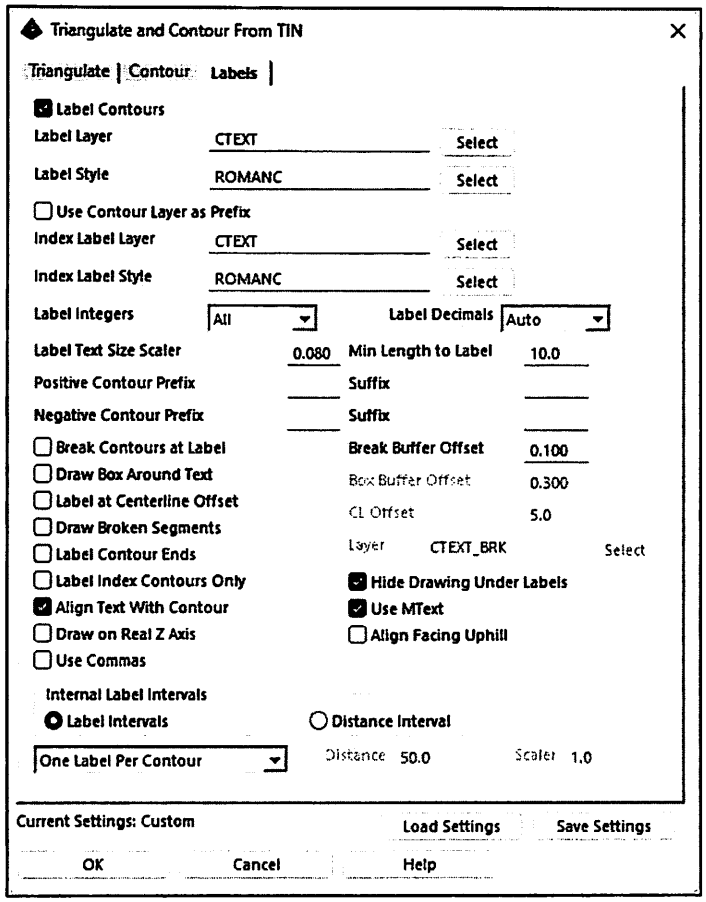
The layer names for the contours can be set to your standards, for this exercise you will leave them as the defaults.

24. Set the **Contour Interval** to **1**.

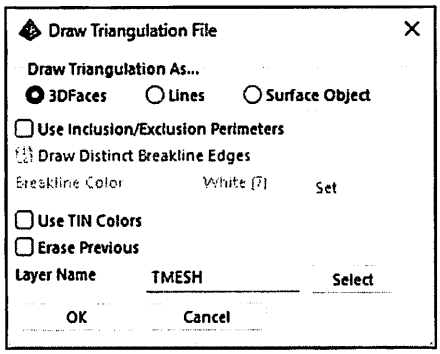
25. Set the **Index Interval** to **5**.



26. Select the **Labels** tab.
27. Enable the **Label Contours** option.
28. For the **Label Text Size Scaler** enter **.08**.
29. Disable the **Break Contours at Label** option.
30. Confirm the **Align Text With Contour** option is enabled.
31. Enable the **Hide Drawing Under Labels** option.
32. Enable the **Use MText** option.
33. Confirm the **Internal Label Intervals** option is set to **Label Intervals**.
34. Confirm the interval is set to **One Label Per Contour**.
35. Click **<<OK>>**.



36. Zoom extents to view the contours.
37. From the pull-down menu: Select **Surface ⇒ Draw Surface ⇒ Draw Triangular Mesh.**
38. Select the surface **Imported_EG.TIN** you just imported and click **<<Open>>**.
39. For **Draw Triangulation As** select **3D Faces**.
40. Click **<<OK>>**.



The surface is displayed as 3D faces in the drawing.

41. Use the **Drawing Viewer** to view the surface.

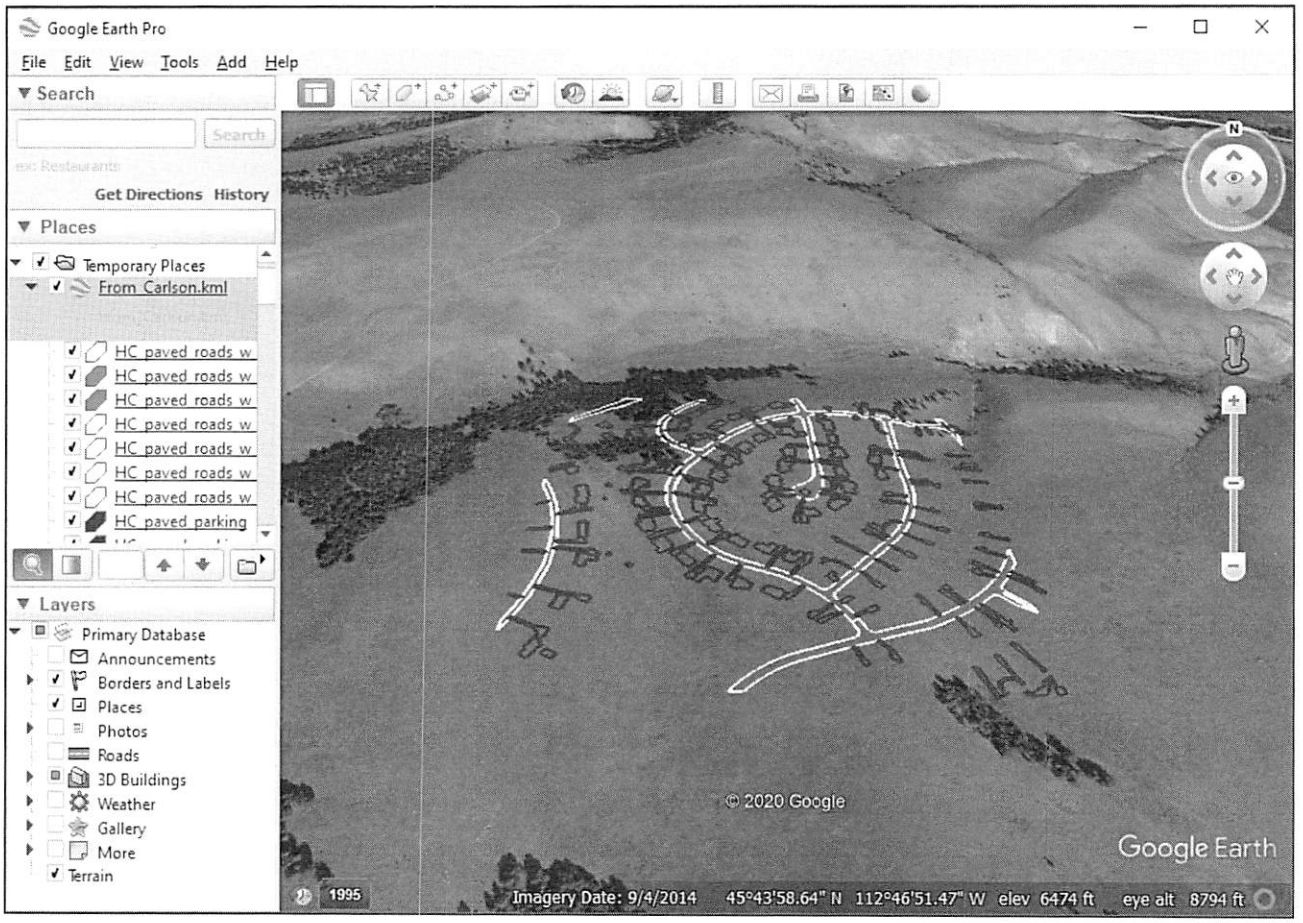
Lesson Review

In this lesson you learned how to employ LandXML functionality in *Carlson Software* to Export and Import Civil/ Survey data to and from this universal format. This is mostly commonly employed to exchange critical data with other professionals using other software solutions than *Carlson.*

6.6 Lesson: Google Earth Export/Import

Introduction

Carlson Software supports the export of drawing entities into *Google Earth* formats, as well as the import of *Google Earth* files.



Key Concepts

Concepts and key terms covered in this lesson are:

- Google Earth Export
- Google Earth Import
- KML/KMZ files

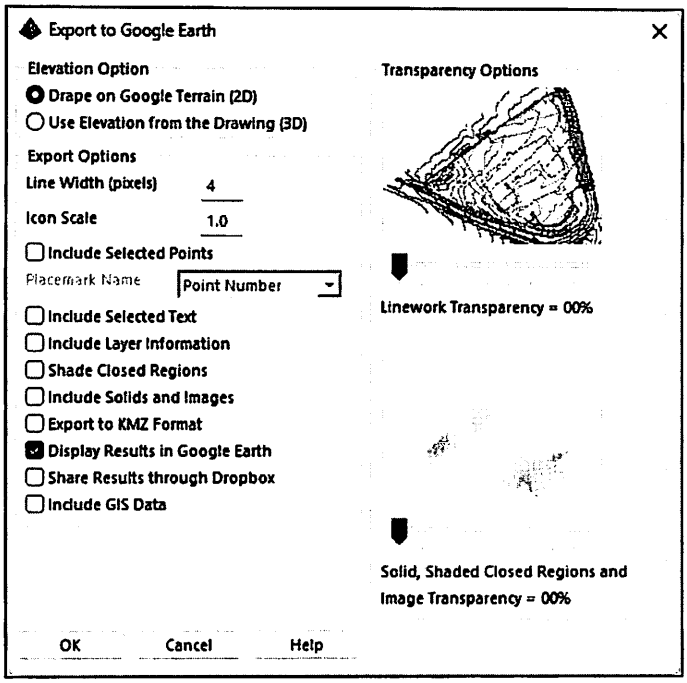
Objectives

After completing this lesson, you will be able to:

- Utilize Google Earth Export to write Carlson entities to KML/KMZ for consumption in Google Earth
- Utilize Google Earth Import to read data in KML/KMZ format for consumption in Carlson

Export to KML/KMZ

When exporting to Google Earth you have several options when creating the KML or KMZ file.



Elevation Option

You can drape the objects you export over the *Google Earth Terrain*. This is great if you export 2D objects as it will use the elevations provided in that area by *Google Earth*.

If you have 3D objects that you are exporting you can use the elevations of those objects that you have assigned in the drawing. Just select the *Use Elevation from the Drawing* option. If the elevations that you have assigned in the drawing do not match the elevation of the *Google Earth* model you may see your objects hover above or sink below the *Google Earth* terrain.

Exercises: Google Earth Export and Import

In these exercises you Export drawing entities to Google Earth KML/KMZ files, and also Import KML/KMZ files into Carlson Software.

Note: You will need *Google Earth* installed for these exercises.

You do the following:

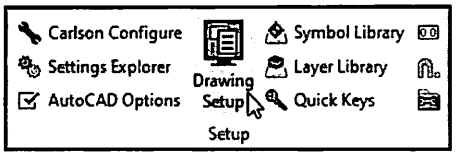
- Export Google Earth
- Import Google Earth

6.6.1 Google Earth Export

1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_6\DWGS\6_6.dwg**

To integrate *Carlson 2023* with *Google Earth*, the coordinate zone projection must be assigned to the drawing file. Access Drawing Setup.

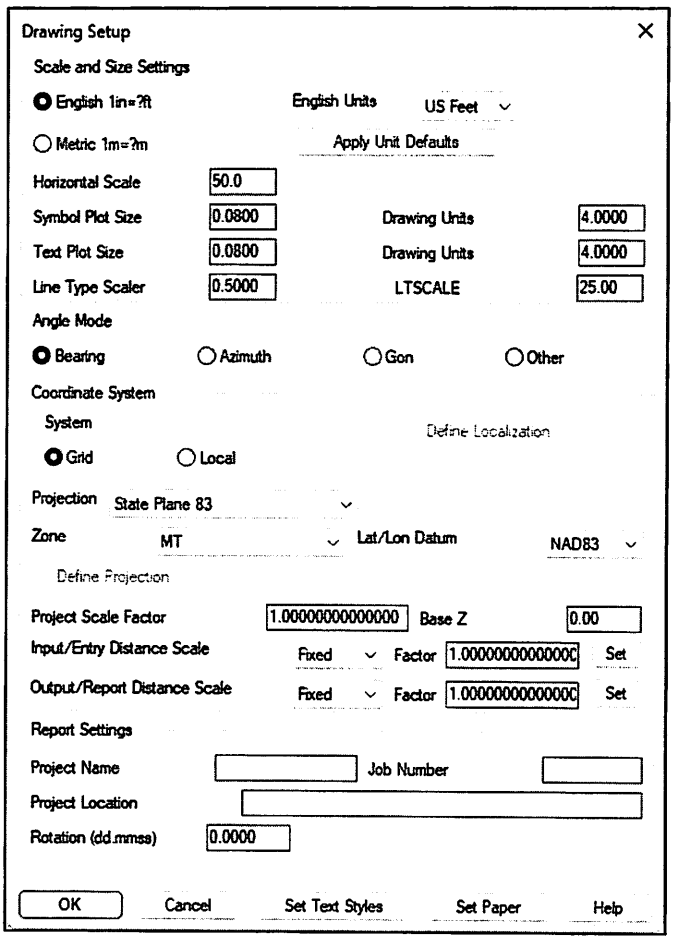
2. Select **Ribbon: Setup ⇒ Setup ⇒ Drawing Setup.**



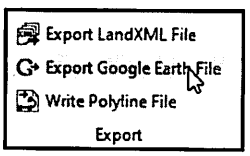
Alternatively, from the pull-down menu:
Select **Settings ⇒ Drawing Setup.**

The *Drawing Setup* dialog box opens.

3. Set the *Coordinate System* settings **System** to **Grid**.
4. Set the **Projection** to **State Plane 83**.
5. Set the **Zone** to **MT**.
6. Set the **Lat/Lon Datum** to **NAD83**.
7. Click **<<OK>>**.



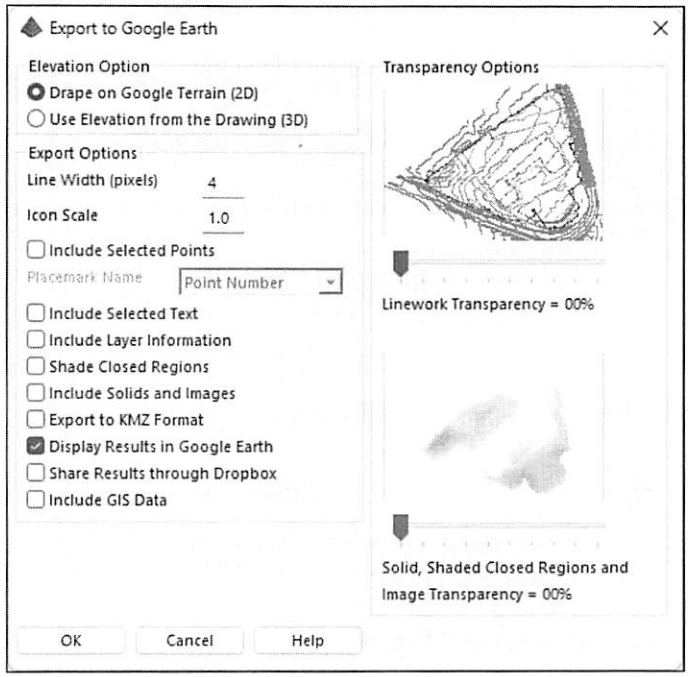
8. Select **Ribbon: File ⇒ Export ⇒ Export Google Earth File.**



Alternatively, from the pull-down menu:
Select **File ⇒ Export ⇒ Google Earth File.**

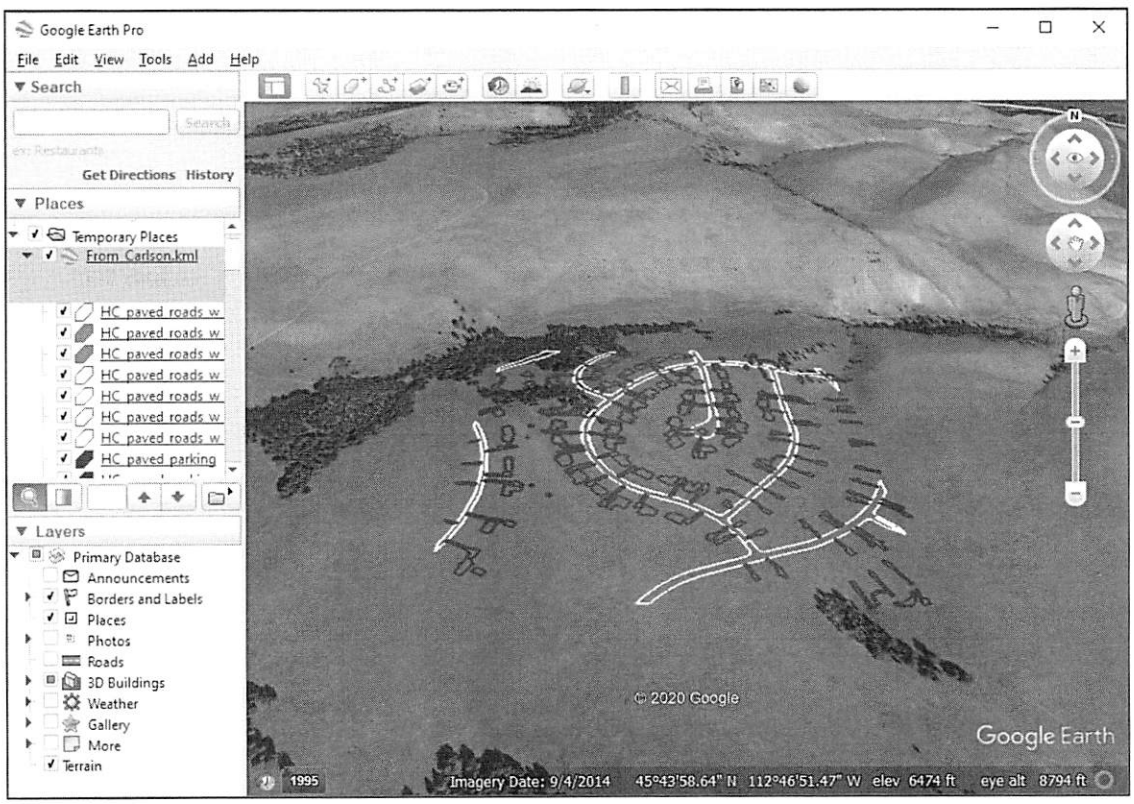
The *Export to KML/KMZ* dialog box opens.

9. Select **Drape on Google Terrain**.
10. Disable **Include Selected Points**.
11. Disable **Include Selected Text**.
12. Disable **Include Layer Information**.
13. Disable **Shade Closed Regions**.
14. Disable **Include Solids and Images**.
15. Disable **Export to KMZ Format**.
16. Enable **Display Results in Google Earth**.
17. Disable **Share Results through Dropbox**.
18. Click **<<OK>>**.



19. Name the KML file **From_Carlson.KML**.
20. Click **<<Save>>**.
21. Select the polylines in the drawing and press **Enter**.

A KML file is created and is launched in Google Earth. The polylines you selected are located on the globe in their correct location. Use *Google Earth* 3D viewing to see the objects draped on the *Google Earth* terrain.



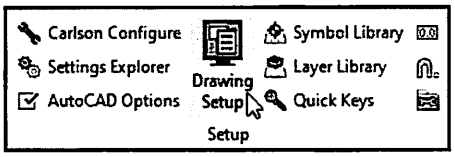
6.6.2 Google Earth Import

1. Create a new *Drawing* named **Import** in the project called *APG Software Lesson 6_6.*

If you have questions about the process refer to *Lesson 2.3.*

To integrate *Carlson Software* with *Google Earth*, the coordinate zone projection must be assigned to the drawing file.

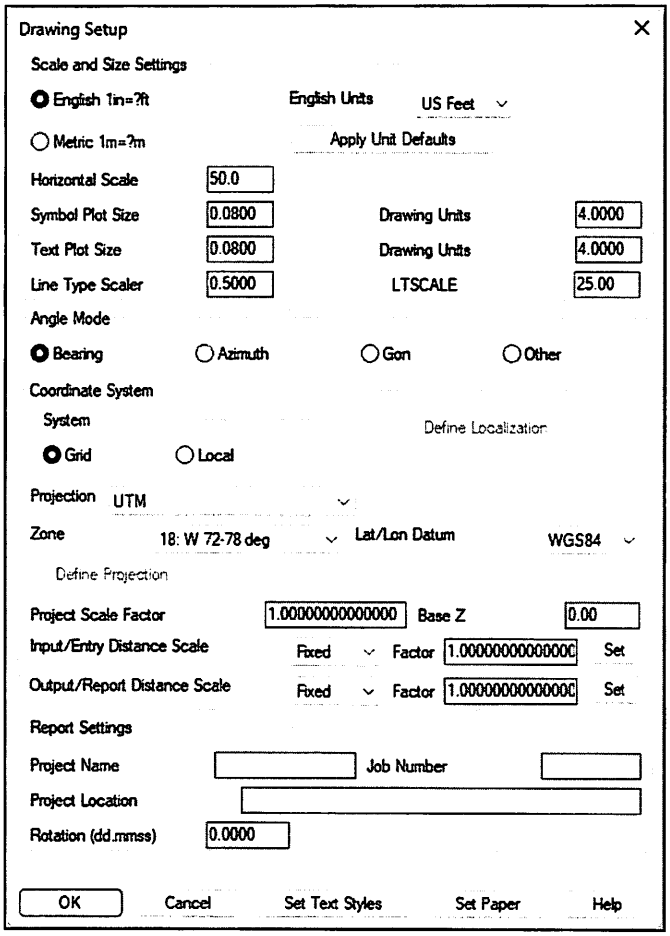
2. Select **Ribbon: Setup ⇒ Setup ⇒ Drawing Setup.**



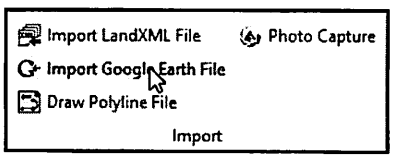
Alternatively, from the pull-down menu:
Select **Settings ⇒ Drawing Setup.**

The *Drawing Setup* dialog box opens.

3. Set the *Coordinate System* settings **System** to **Grid.**
4. Set the **Projection** to **UTM.**
5. Set the **Zone** to **18: W 72-78 deg.**
6. Set the **Lat/Lon Datum** to **WGS84.**
7. Click **<<OK>>.**



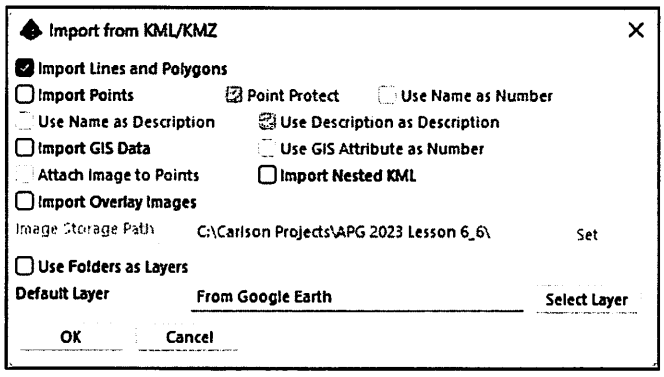
8. Select **Ribbon: File ⇒ Import ⇒ Import Google Earth File.**



Alternatively, from the pull-down menu:
Select **File ⇒ Import ⇒ Google Earth File.**

The Import from KML/KMZ dialog box opens.

9. Enable the option to **Import Lines and Polygons**.
10. Disable **Import Points**.
11. Disable **Import Overlay Images**.
12. Disable **Use Folders as Layers**.
13. Enter a layer name of **From Google Earth**.



14. Click **<<OK>>**.
15. Browse and select the file: **C:\Carlson Projects\APG 2023 Data\Google\APG Training.KMZ**.
16. Click **<<Open>>**.

The file is Imported into the drawing.

17. Zoom Extents.
18. View the contours with the **Drawing Viewer**.

The polylines are 2D polylines at elevation.

Lesson Review

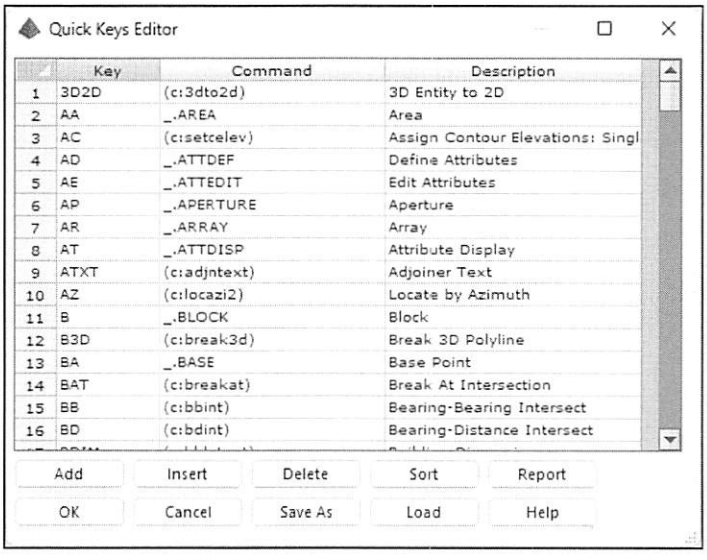
In this lesson you learned how to Export and Import Google Earth KML/KMZ files for use with *Carlson Software*.

6.7 Lesson: Working with Quick Keys

Introduction

Carlson Software provides the ability to customize one and two letter keyboard shortcuts as user input. Carlson calls these Quick Keys. An easy to use user interface is provided to set these up as desired and save them.

Note: Carlson with embedded AutoCAD, also known as the OEM version, does not allow for this customization.



Key Concepts

Concepts and key terms covered in this lesson are:

- Quick Keys

Objectives

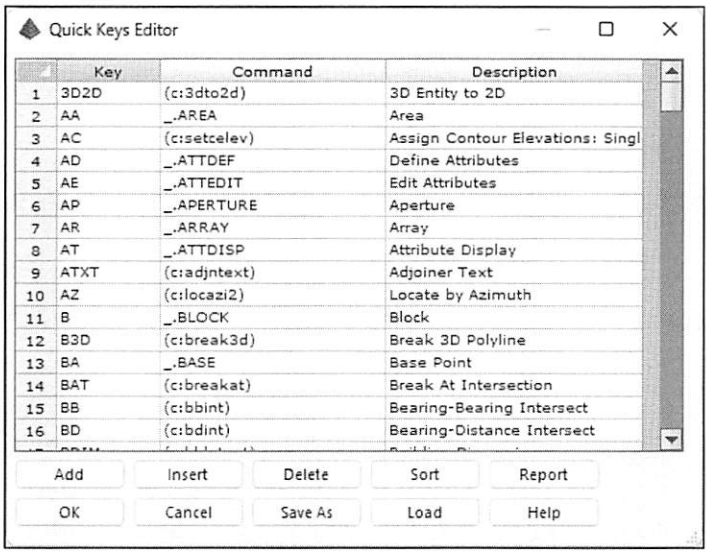
After completing this lesson, you will be able to:

- Customize Quick Keys for keyboard input of commands

Quick Keys Editor

In the *Quick Keys Editor* command *Keys* can easily be edited in the list. *Keys* can also be deleted if they are unwanted or if they conflict with a new desired key and new *Keys* can be added.

The *Quick Key* list can be saved as a .QKS file and a pre-defined .QKS file can be loaded. A report of the current list of keys can also be generated.



The *Quick Keys Editor* displays the shortcut characters to be typed as the *Key*, and the full command name that would alternately be typed as the *Command*.

- Commands that use the underlying CAD program are prefaced with an underscore.
- The commands that come from the embedded C&G survey program all begin with "CG_" in the command column.
- Carlson commands are shown enclosed in square brackets, and all begin with "c:" followed by the name of the Carlson command.

The *Carlson Survey Quick Keys* do not use or affect the ACAD.PGP file, but if identical keys are defined in both, *Quick Keys* will take precedence.

Exercise: Setting up Quick Keys

In this exercise you learn about the Quick Keys Editor, and set Quick Keys to your preferences for keyboard shortcuts.

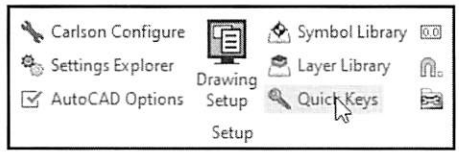
You do the following:

- Access Quick Keys
- Edit Quick Keys

6.7.1 Creating Quick Keys

1. Open any drawing or begin a new drawing to investigate quick keys.

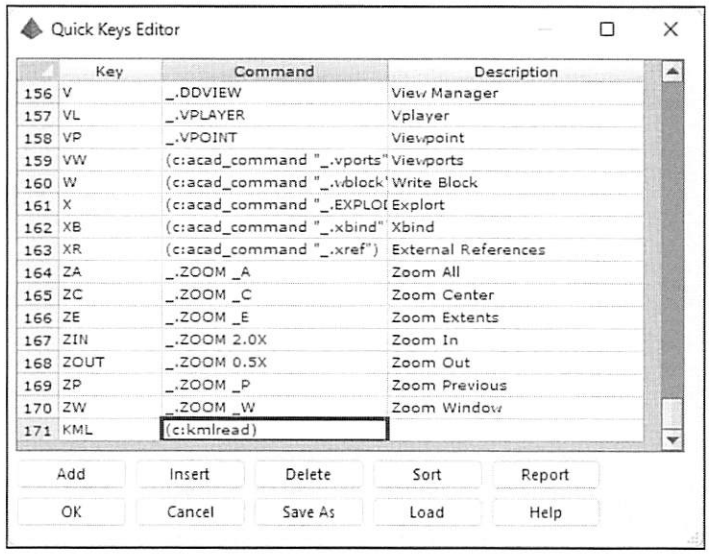
2. Select **Ribbon: Setup ⇒ Setup ⇒ Quick Keys.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Quick Keys.**

The *Quick Keys Editor* dialog box is opened.

All of the keyboard shortcuts that ship with *Carlson Software* are listed.



3. Click **<<Add>>**.

4. Enter **KML** as the **Key**.

5. In the **Command** column enter **(c:kmlread)**.

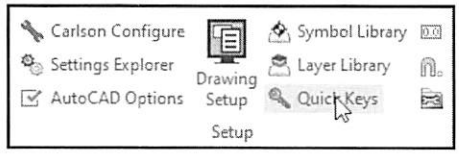
6. Click **<<OK>>**.

7. At the command line type **KML** and **Enter**.

The *Google Import* command is invoked.

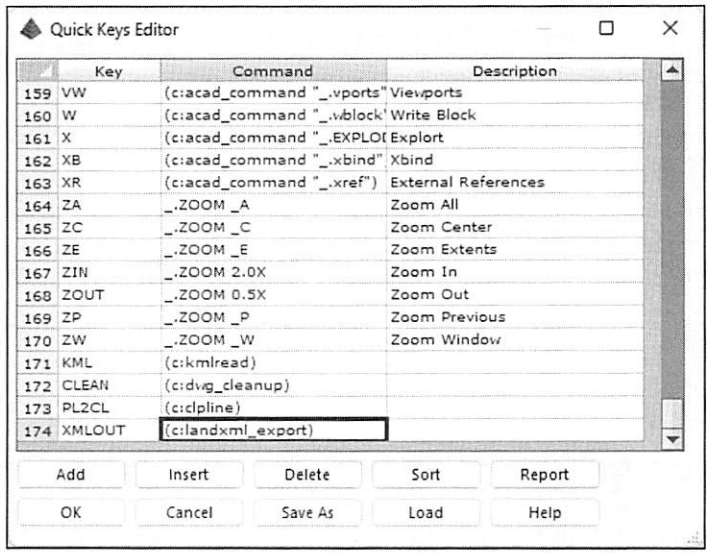
8. **Cancel** out of the *Google Import* command.

9. Select **Ribbon: Setup ⇒ Setup ⇒ Quick Keys.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Quick Keys.**

10. Click **<<Add>>**.
11. Enter **CLEAN** as the **Key**.
12. In the **Command** column enter **(c:dwg_cleanup)**.
13. Click **<<Add>>**.
14. Enter **PL2CL** as the **Key**.
15. In the **Command** column enter **(c:clpline)**.
16. Click **<<Add>>**.
17. Enter **XMLOUT** as the **Key**.
18. In the **Command** column enter **(c:landxml_export)**.
19. Click **<<OK>>**.
20. Test the new Keyboard Shortcuts.



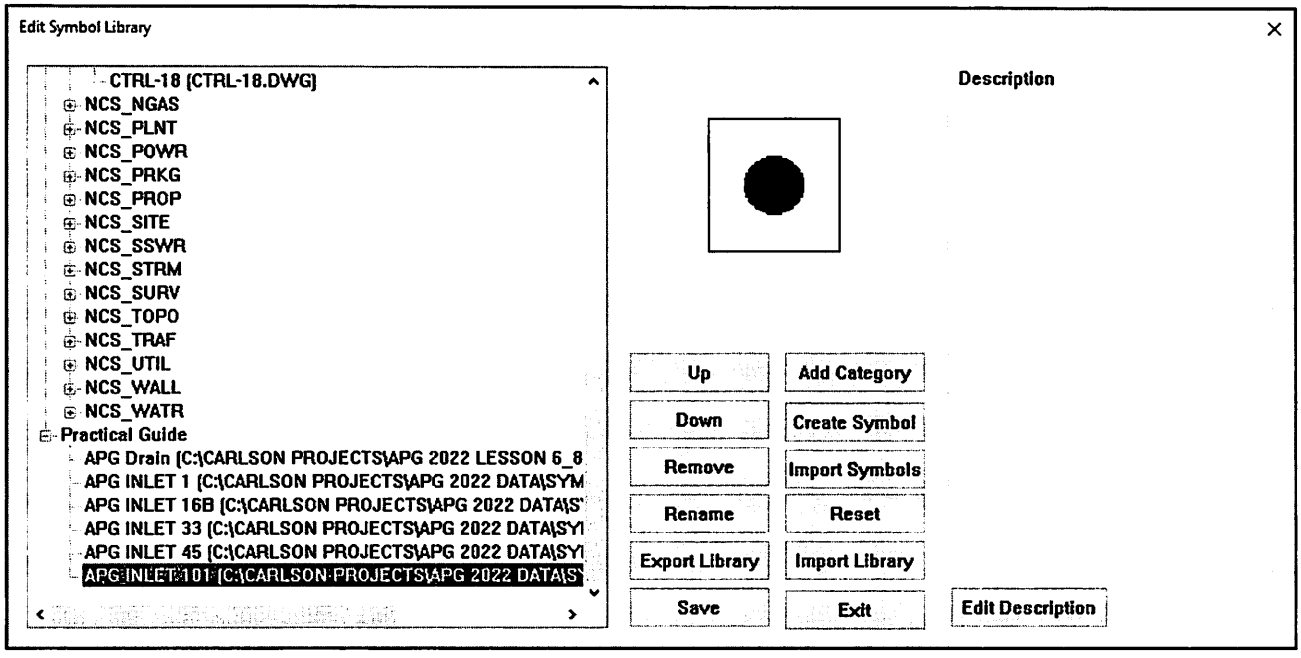
Lesson Review

In this lesson you learned how to customize *Quick Keys* in *Carlson Software* to facilitate the launching of commands from keyboard shortcut input.

6.8 Lesson: Working with the Symbol Library

Introduction

The *Symbol Library* is the tool that *Carlson Software* uses to organize and provide access to symbols. A *Symbol Library* is a list of Categories, each containing any number of symbols. The list of Categories and the names of the Symbols populating each Category can be exported to and imported from symbol library files, called .SLI files, for shared use by multiple end users. The *Symbol Library Editor* also provides a quick and easy way to Create new Symbols from drawing entities, on the fly, without defining a block or a symbol drawing first.



Key Concepts

Concepts and key terms covered in this lesson are:

- Symbol Library
- Categories
- .SLI files
- Create New Symbol
- Export .SLI
- Import .SLI

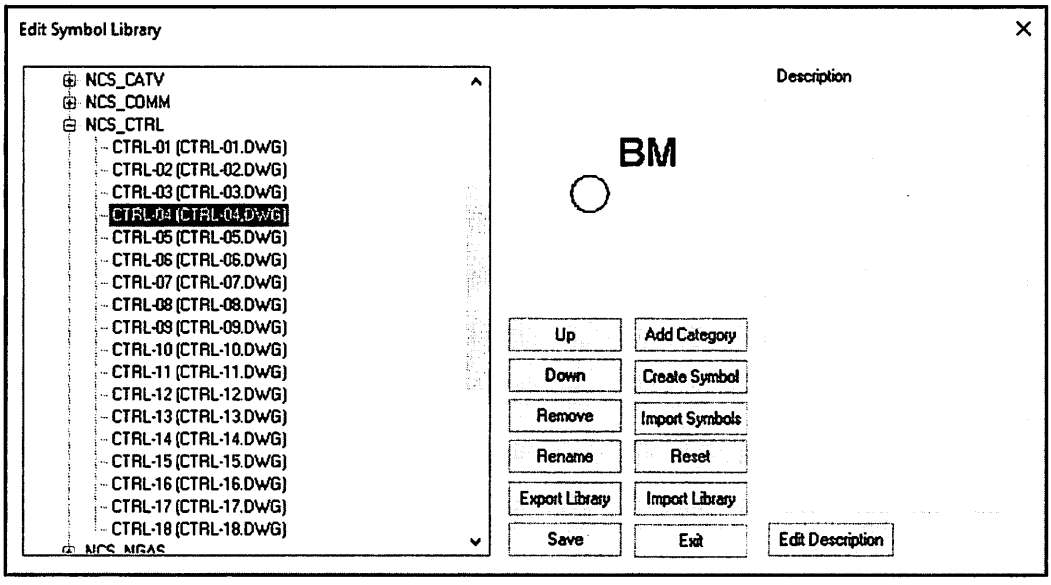
Objectives

After completing this lesson, you will be able to:

- Access the Symbol Library Manager
- Create a New Category
- Add a New Symbol to an Existing Category
- Import a Folder of Symbol files (.DWG's) into the Library
- Export a Symbol Library .SLI file
- Remove the new Category
- Import the Symbol Library .SLI file

Symbol Library Files

Symbol Library Files are .SLI files, and store a list of Symbols, Organized into Categories. Each Symbol listed in the file references a .DWG file. The referenced .DWG files can be stored anywhere, providing easy access to any number of end users.



Categories

Categories are simply used to organize the Symbol Library to make it easier to use.

Create a New Symbol

The Create Symbol option in the Edit Symbol Library dialog box allows you to define a new Symbol as a .DWG drawing file, from drawing entities, and store a reference to it in the current Symbol Library, all on the fly, without the prerequisite of creating a drawing block definition or a .DWG first.

Export Library

The Export Library option in the Edit Symbol Library dialog box allows you to Export the current definition of Categories and Symbols to an external .SLI file, which can be Imported by any other end user to instantly recreate the Library structure on their system.

Import Library

The Import Library option in the Edit Symbol Library dialog box allows you to Import a predefined Symbol Library structure, stored in an external .SLI file. This instantly recreates the Symbol Library structure on the current computer system for immediate use. These Export and Import capabilities make it easy to have all end users within an organization using the same Symbols in their work.

Using Symbol Libraries

There are many commands and functions in Carlson that access the Symbol Library. These include Field to Finish, Draw-Locate Points, and the Insert Symbols command itself.

Exercises: Using the Symbol Library Editor

In these exercises you access the Symbol Library command, look through the Symbols currently there, add a new Symbol from some simple linework in your drawing, and also create a new Category and Import a set of Symbols in a folder to populate it. You then Export a new .SLI, delete the new Category, and then Import the new .SLI to recreate it.

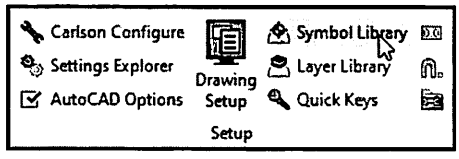
You do the following:

- Access Symbol Library
- Inspect Categories and Symbols currently available
- Make a new Category
- Create a new Symbol on the fly
- Import a set of new Symbols
- Export the expanded Symbol Library as a .SLI file
- Delete the new Category
- Restore it by Importing the newly created .SLI file

6.8.1 Editing the Symbol Library

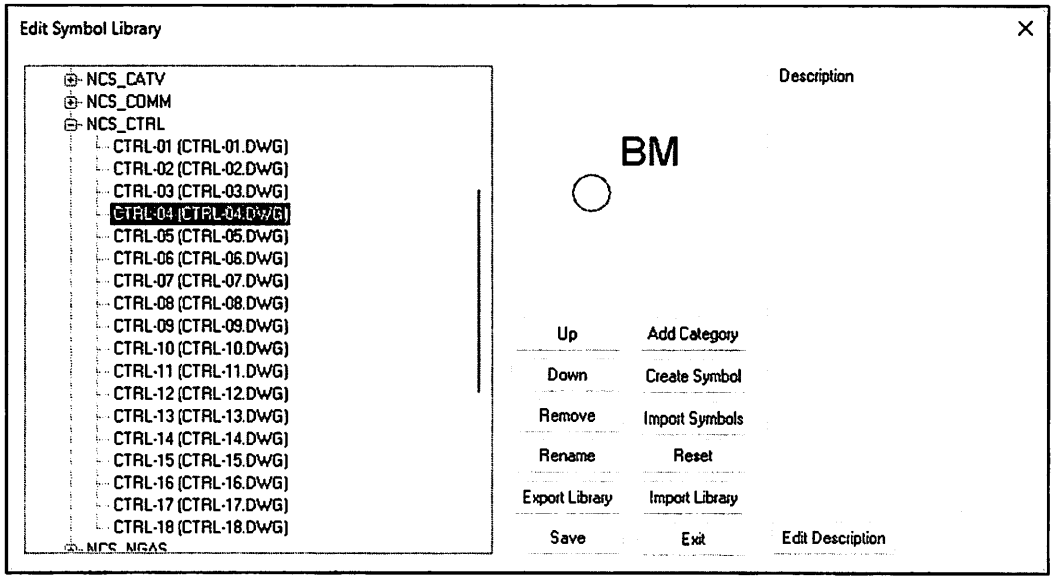
1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_8\DWGS\6_8.dwg**

2. Select **Ribbon: Setup ⇒ Setup ⇒ Symbol Library.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Symbol Library.**

3. The *Edit Symbol Library* dialog box opens.



4. Inspect the list of *Categories*.

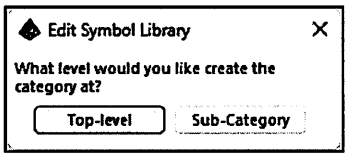
The *NCS* categories contain symbols endorsed by the *National CAD Standards* endeavor.

5. Expand any Category.

6. Inspect the names and visual previews of the available symbols.

7. Click **<<Add Category>>**.

8. Click **<<Top-level>>**.



A new Category folder is created, called New Category. It is highlighted in preparation of immediately entering a new Category Name.

9. Enter **Practical Guide** for the new **Category Name**. Press **Enter**.

10. Click **<<Create Symbol>>**.

11. Enter the name **APG Drain**.

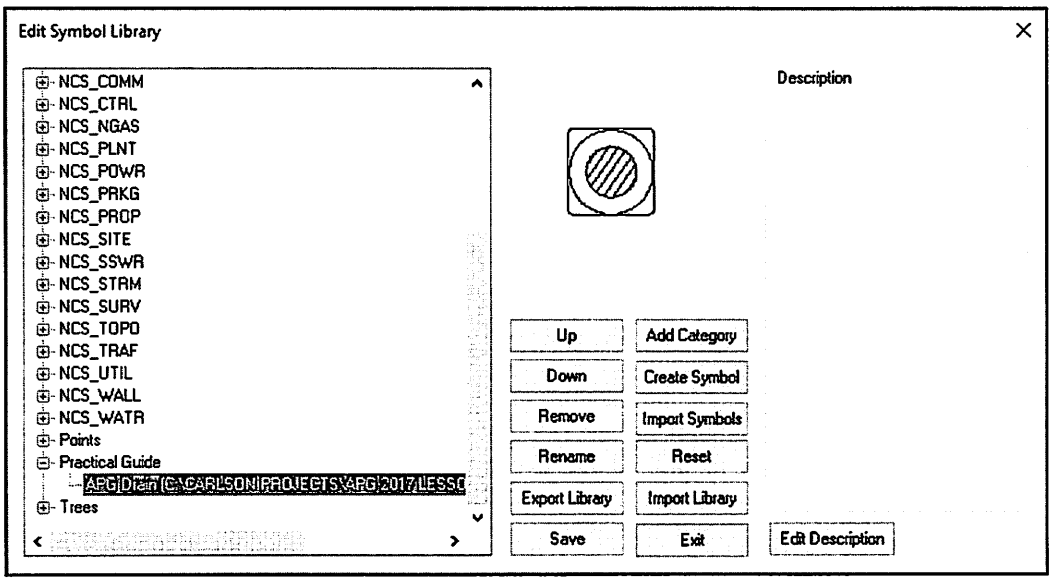
12. Click **<<OK>>**.

You are prompted to specify a location for the new .DWG that you are about to create. The dialog defaults to the Carlson Software SUP directory, which is where the standard symbols that ship with Carlson Software are stored. You can browse to any other location. In an office environment, you might choose a network location so that all users have access to and use the same file.

13. Browse to the **C:\Carlson Projects\APG 2023 Lesson 6_8\DWGS** folder and click **<<Save>>** to save the new drawing with the same name you assigned to the symbol, **APG Drain.dwg**.

14. At the command line when you are prompted to select objects, select the linework for the drain symbol drawn in the drawing and press **Enter**.

15. You are prompted for an Insertion Point for the new Symbol/DWG. Use a Center Snap to pick the center of the circle.



16. You are returned to the Edit Symbol Library dialog box, and the new Category now lists the new Symbol. Pick it to preview it. Click **<<Save>>**.

Next you will import several drawings as symbols into the new category.

17. Pick the **Practical Guide** category to highlight it in the list.

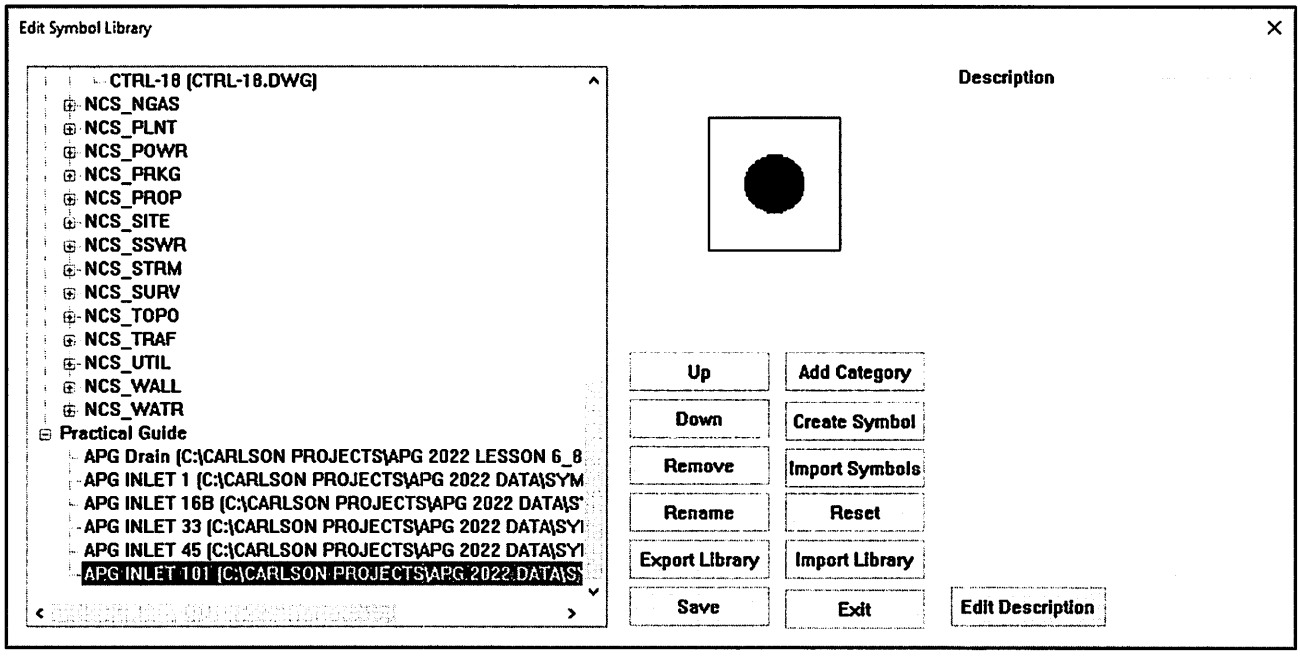
18. Click **<<Import Symbols>>**.

19. Navigate into the **C:\Carlson Projects\APG 2023 Data\Symbols** folder. Use the Shift key to select all the drawings in the folder and click **<<Open>>**.

20. You are prompted to indicate if you want the drawings copied to the Carlson Support directory. For this exercise, click **<<No to All>>**.

All of the symbols are added to the Practical Guide Category.

21. Click **<<Save>>**.



22. The Symbols are added to the *Practical Guide* category. Pick each one to preview it.

Next you will export the symbol library. This is useful if you want to share it with others in your office.

23. Highlight the **Practical Guide** category.

24. Click **<<Export Library>>**.

25. Name the new file **Practical.SLI** and save it in the default folder *C:\Carlson Projects\Settings*.

26. Click **<<Save>>.**

Next you will remove the new category and then restore it by importing the new *Symbol Library Index* .SLI file.

27. Highlight the **Practical Guide** category.

28. Click **<<Remove>>**.

29. Click **<<Yes>>** to confirm the deletion of the Category. Note the Category is now gone.

30. Click **<<Import Library>>**.

31. Click **<<Yes>>** to *Merge symbols with existing library*.

32. Select the newly created .SLI file **C:\Carlson Projects\Settings\Practical.SLI**.

33. Click **<<Open>>**.

The new Practical Guide category is redefined in the current Symbol Library. This demonstrates how you could move the symbol library to other computers.

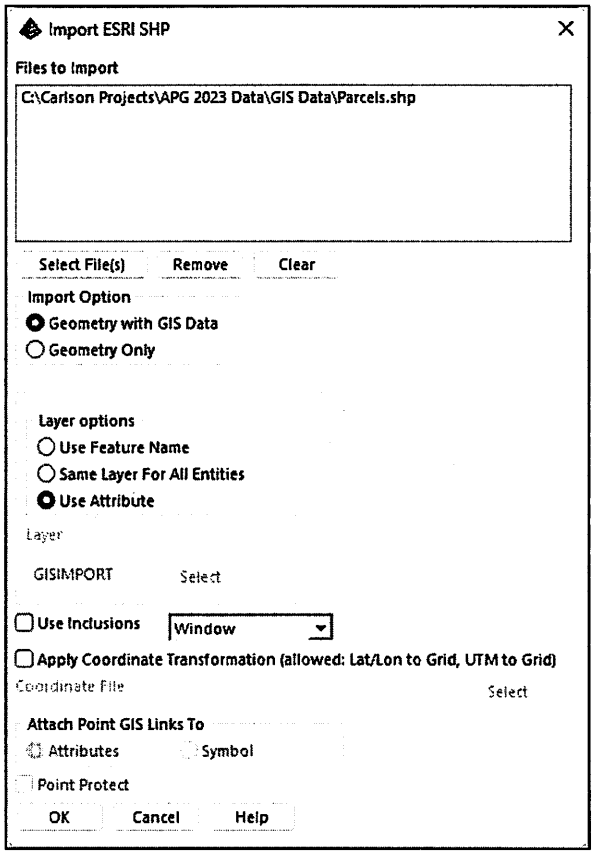
Lesson Review

In this lesson you learned how to work with and edit the *Symbol Library* in *Carlson Software*.

6.9 Lesson: Importing Esri SHP Files

Introduction

Much data is available from a wide variety of sources in an ESRI SHP file format. Carlson Survey or Carlson GIS can import these files, with or without the associated data.



Key Concepts

Concepts and key terms covered in this lesson are:

- GIS Settings
- ESRI SHP
- GIS Inspector

Objectives

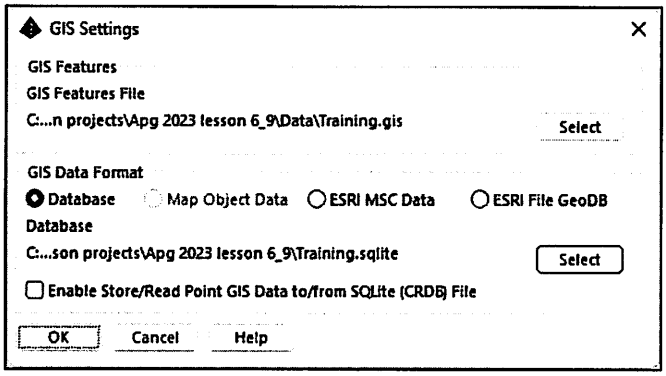
After completing this lesson, you will be able to:

- Describe Carlson GIS Settings
- Import entities and/or data stored in an ESRI SHP format

GIS Settings

The *GIS Settings* include settings for two different files:

- GIS Features File
- GIS Data Format



GIS Features File

The *GIS Features File* is a file with a .GIS extension that stores the schema of features and attributes in a user defined database.

GIS Data Format

The *GIS Data Format* is a database that the data from the SHP is written to.

Exercises: Import ESRI SHP to Polylines and Inspect the Associated Data

In this exercise you Import an ESRI SHP dataset, draw the graphics as polylines and then Inspect the data that was Imported with the graphics.

You do the following:

- Set up GIS Settings for ESRI SHP Import
- Import SHP
- Use GIS Inspector

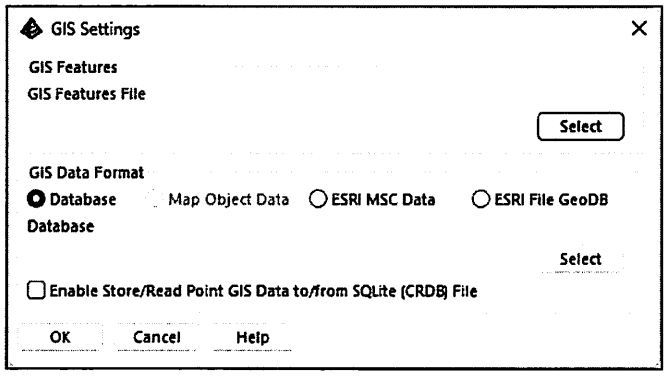
6.9.1 Configure GIS Settings

1. Create a new *Project* called **APG 2023 Lesson 6_9** and a new *Drawing* named **GIS Import**.

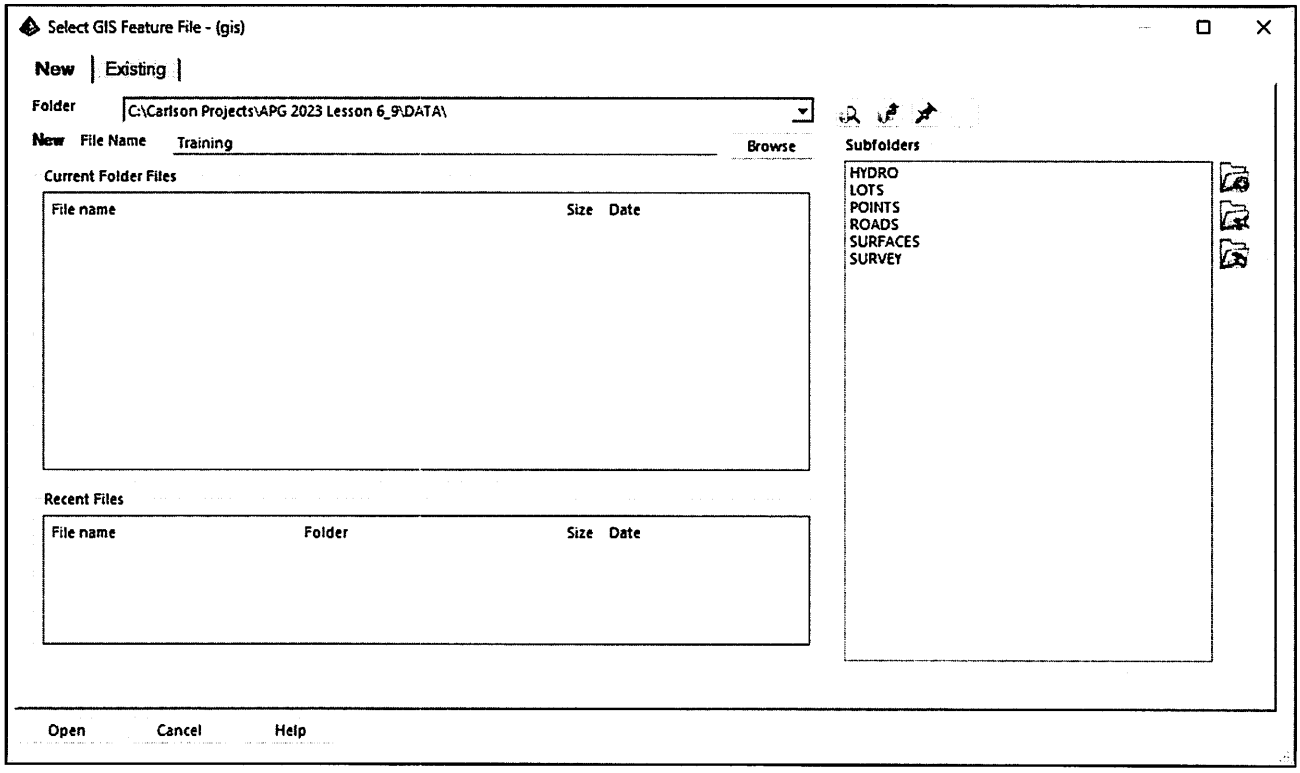
If you have questions about the process refer to *Lesson 2.3*.

Before importing an ESRI SHP file, you will configure the *GIS Settings*.

2. From the pull-down menu: Select **GIS ⇒ GIS Settings.**



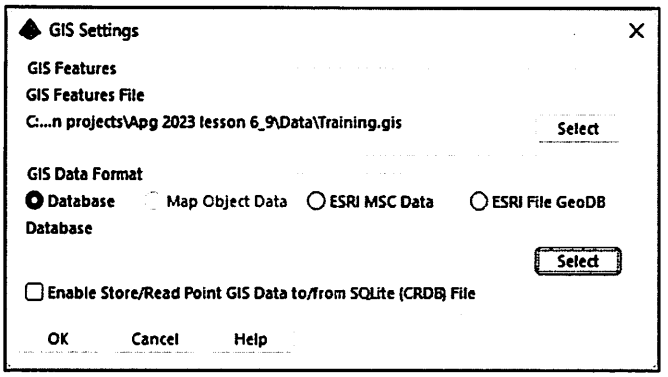
3. In the *GIS Settings* dialog box, click **<<Select>>** next to the **GIS Features File.**



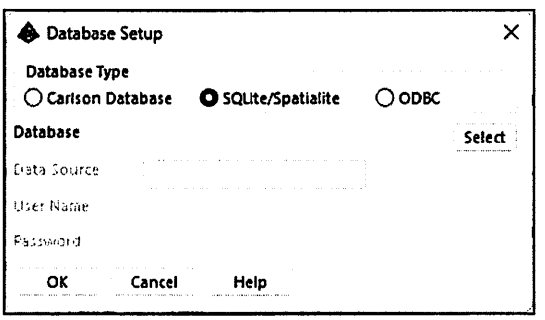
4. In the *Select GIS Features File* dialog box, select the **New** tab.

5. Browse and create a new file:
   C:\Carlson Projects\APG 2023 Lesson 6_9\DATA\Training.gis

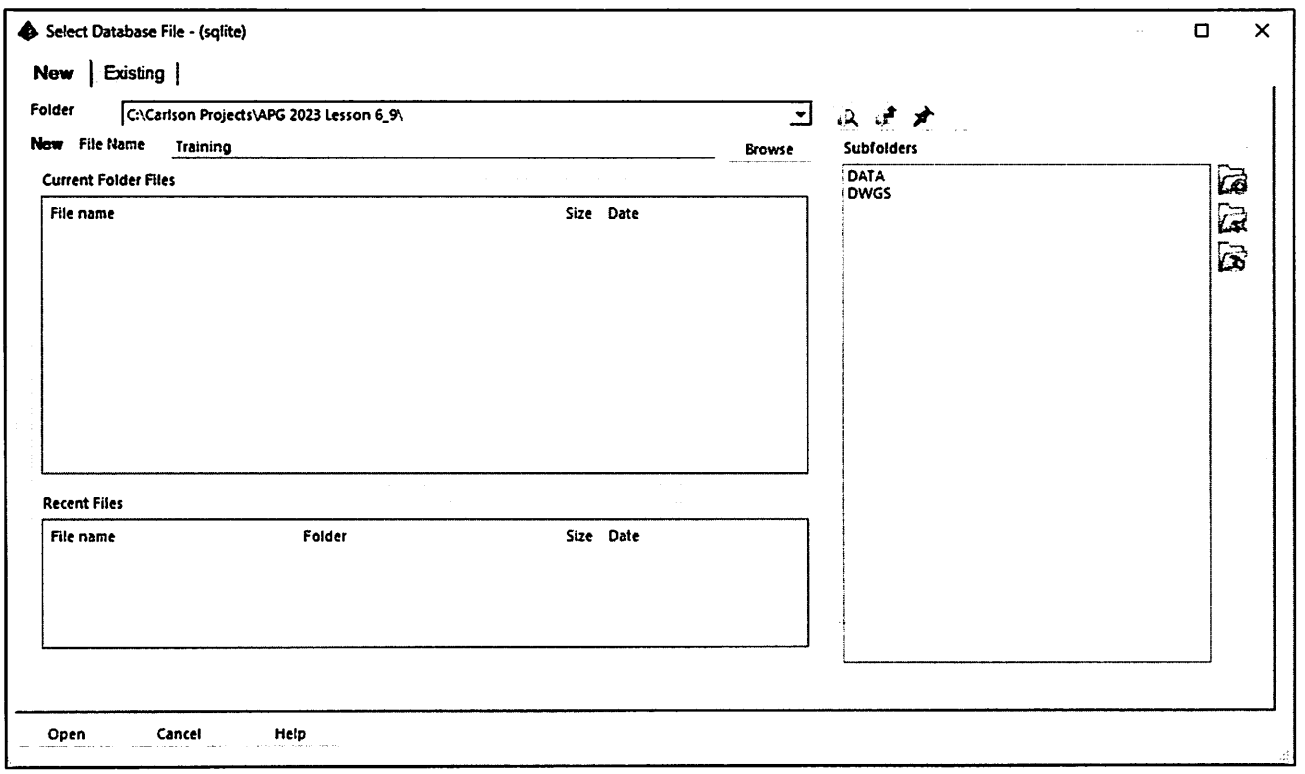
6. Click **<<Open>>**.



7. Back in the *GIS Settings* dialog box, set the **GIS Data Format** to **Database**.
8. Click **<<Select>>** next to the **Output Database File**.
9. Select **SQLite/Spatialite** for the **Database Type**.
10. Click **<<Select>>**.

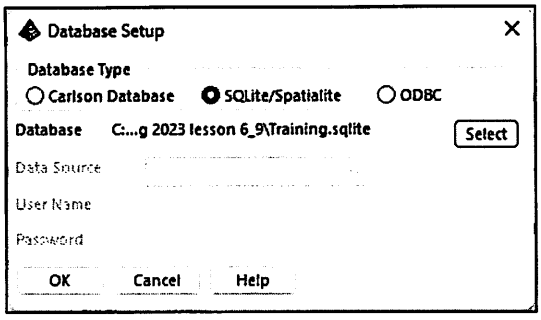


The *Select Database File* dialog box opens.

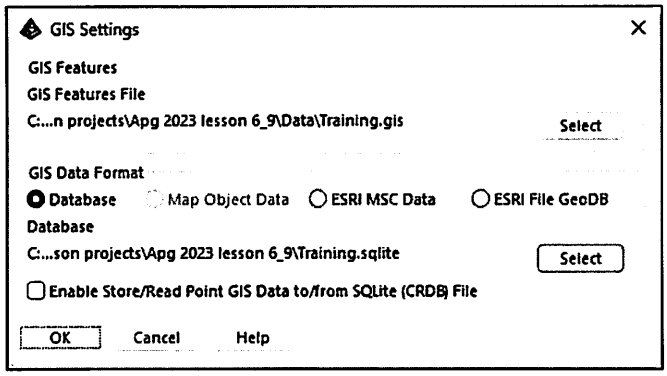


11. Browse and create a new file:
    C:\Carlson Projects\APG 2023 Lesson 6_9\DATA\Training.sqlite

12. Back in the *Database Setup* dialog box,
click **<<OK>>**.



13. Back in the *GIS Settings* dialog box,
click **<<OK>>**.



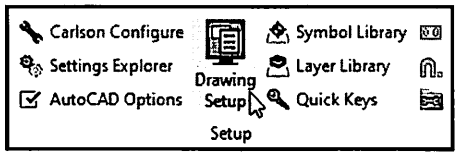
This completes the set up required prior to performing the import.

6.9.2 Import Esri SHP

Typically, .SHP files are utilized in a geo-referenced environment. So your drawing should have the correct coordinate zone assigned to it. If the files that make up the Esri SHP include a .PRJ (projection file), *Carlson Software* can perform a coordinate zone transformation on import, from the coordinate zone, and units, used in the.SHP, to the coordinate zone and units assigned to the drawing.

1. Continue working in the drawing from the previous exercise.

2. Select **Ribbon: Setup ⇒ Setup ⇒ Drawing Setup.**



Alternatively, from the pull-down menu:
Select **Settings ⇒ Drawing Setup.**

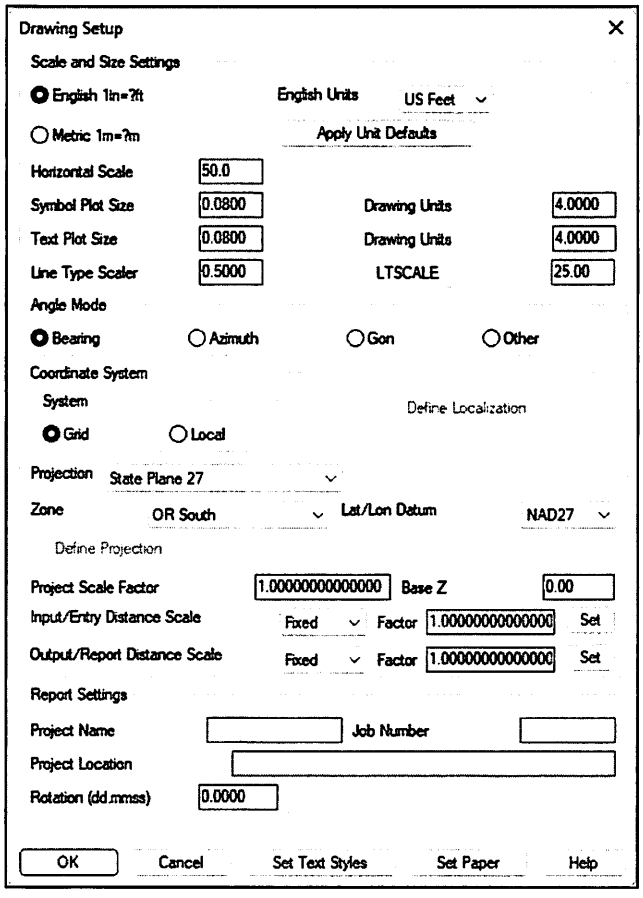
3. In the *Drawing Setup* dialog box, under *Coordinate System*, set the **System** to **Grid**.

4. Set the **Projection** to **State Plane 27**.

5. Set the **Zone** to **OR South**.

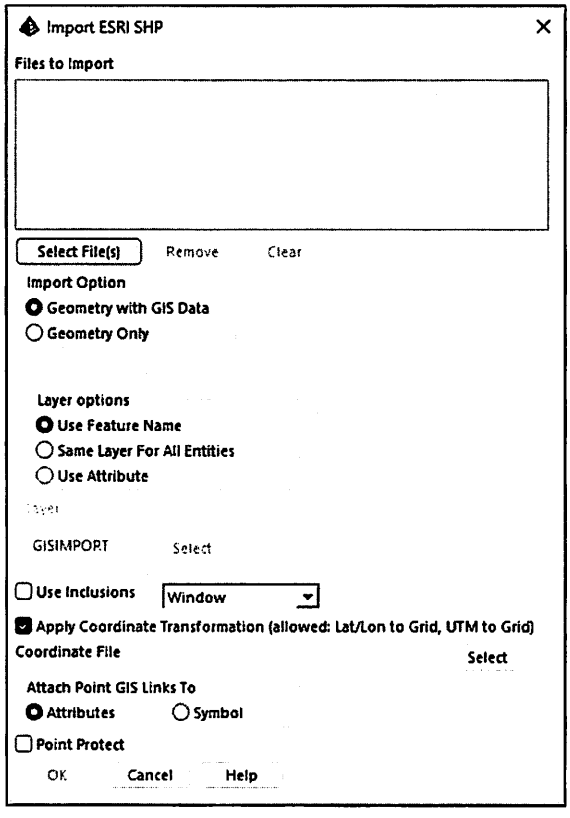
6. Set the **Lat/Lon Datum** to **NAD27**.

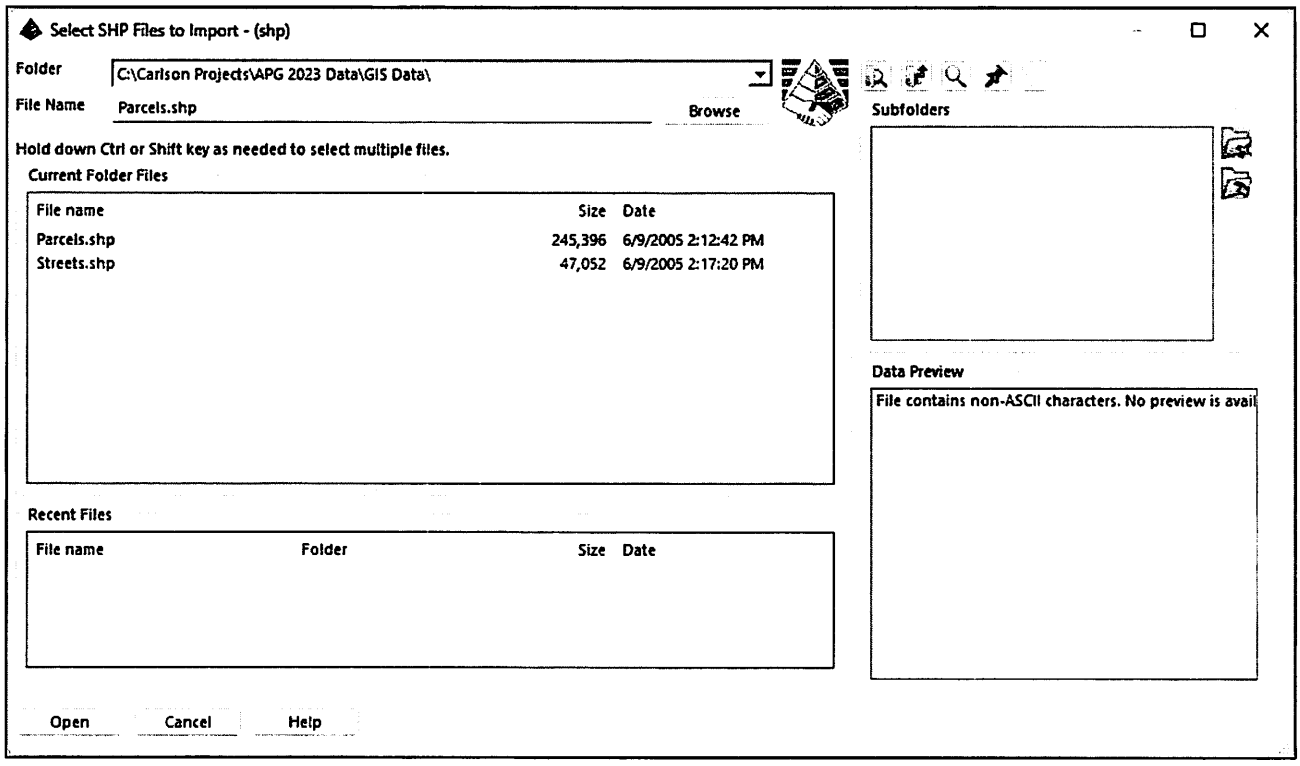
7. Click **<<OK>>**.



8. From the pull-down menu: Select **GIS ⇒ Import ESRI SHP File.**

9. In the *Files to Import* area click **<<Select File(s)>>**.



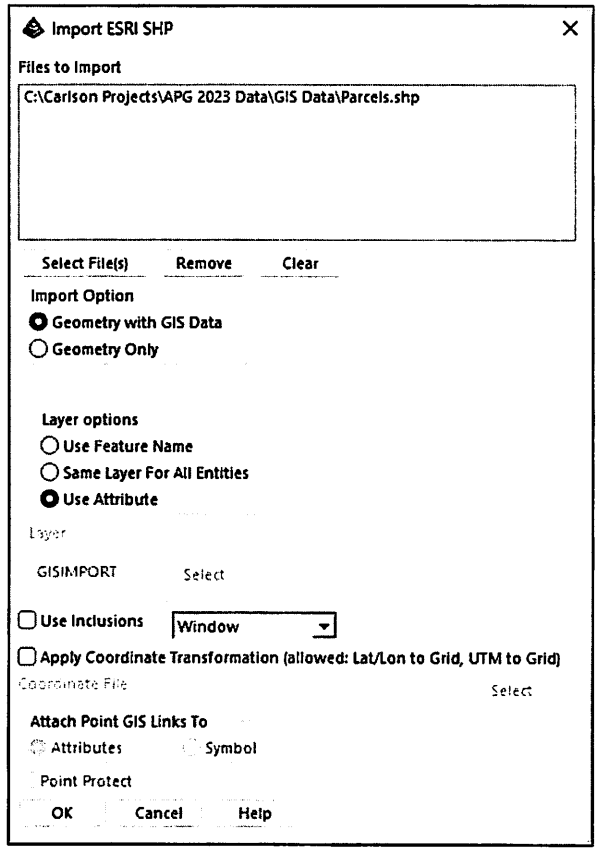


10. Browse to the file: **C:\Carlson Projects\APG 2023 Data\GIS Data\Parcels.shp**

11. Click **<<Open>>**.

12. Back in the *Import ESRI SHP* dialog box, in the *Import Option* section select **Geometry with GIS Data**.

13. In the *Layer options* section select **Use Attribute**.

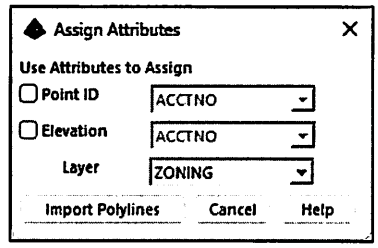


This will place the parcel polylines on different layers according to the value of one of the attributes. That attribute defining the layers will be selected in the next steps.

14. Disable the **Allow Coords Transformation** option.

15. Click **<<OK>>**.

16. Set the **Layer** to **Zoning**.



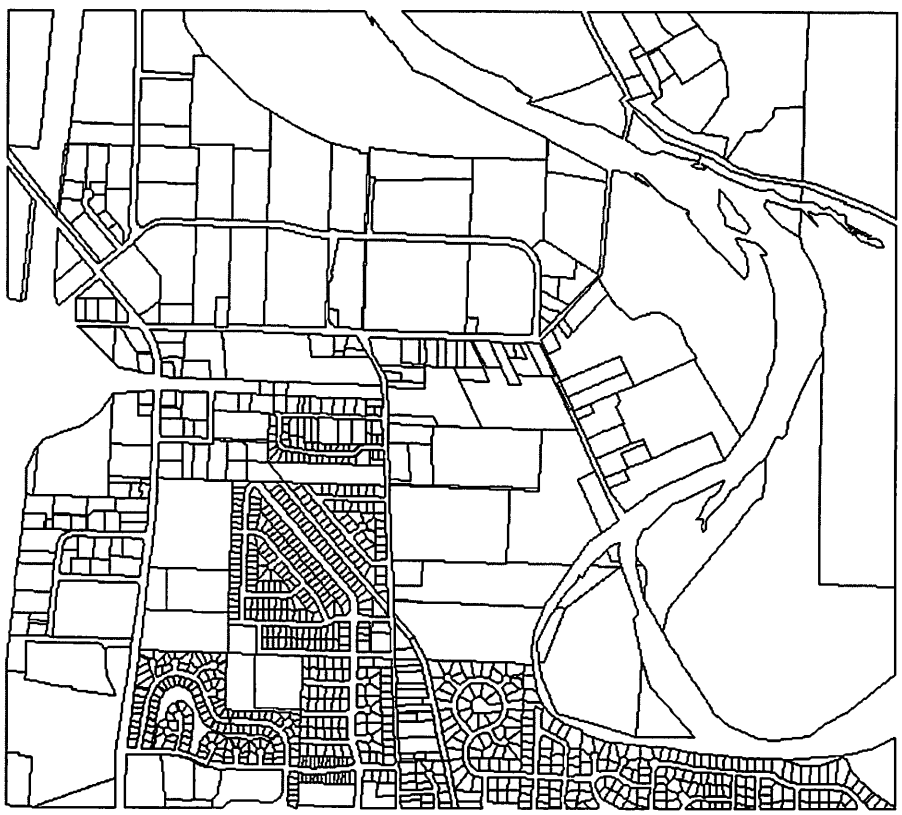
This will place the parcel polylines on different layers according to the value of the *Zoning* attribute.

17. Click **<<Import Polylines>>**.

The import may take several minutes. The geometry defined in the SHP file is converted to polylines in the drawing. The associated attribute data is written to the external database and the two are linked.

18. **Zoom Extents** to view the parcels you just imported.

The parcels should look like the graphic below.



19. Open the *Layer Properties Manager* and notice a layer was created for each unique *Zoning* value in the *SHP File* that was imported.

You can now manage the parcels using layers based on their zoning values.

6.9.3 Viewing the GIS Data

Now that you have imported the SHP File and all its data, you can view that data a number of ways.

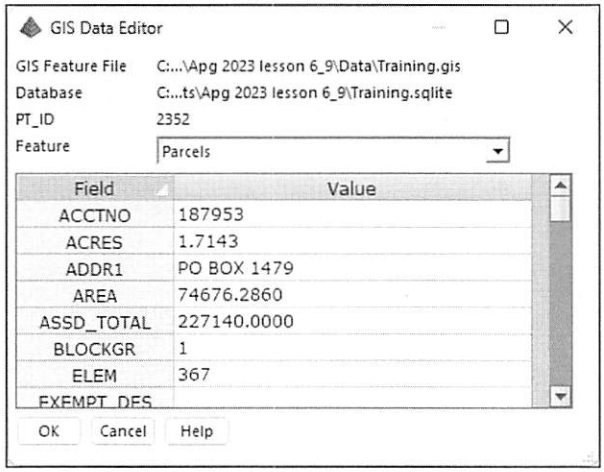
1. Continue working in the drawing from the previous exercise.
2. From the pull-down menu: Select **GIS ⇒ GIS Data Editor.**
3. Select one of the parcels from the screen.

The *GIS Data Editor* dialog box opens and displays all of the GIS data attached to the object you selected.

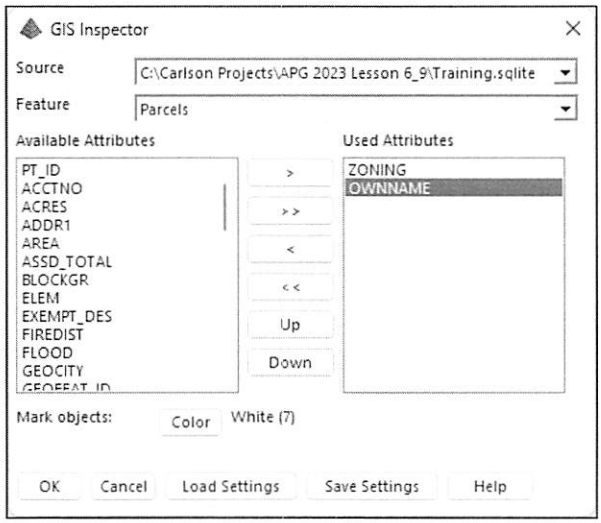
4. Review the GIS data attached to the selected parcel.

This GIS data was imported from the SHP File. You can also edit the data in this dialog box.

5. Click **<<Cancel>>** to close the *GIS Data Editor* dialog box without making any changes.

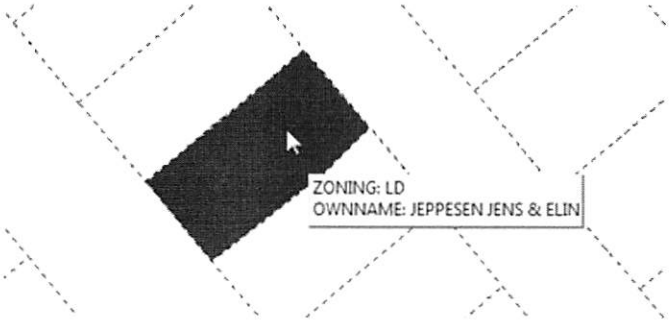


6. From the pull-down menu: Select **GIS ⇒ GIS Inspector.**
7. Select all the parcels with a crossing window and press Enter.



8. In the *GIS Inspector* dialog box, set the **Source** to: **C:\Carlson Projects\APG 2023 Lesson 6_9\DATA\Training.sqlite**
9. Set the **Feature** to **Parcels**.
10. Under **Available Attributes**, select the **Zoning** attribute.

11. Double-click on **Zoning** to add the attribute.
12. Select the **OWNNAME** attribute.
13. Double-click on **OWNNAME** to add the attribute.
14. Click **<<OK>>**.
15. As you hover over the objects, they are highlighted, and the specified GIS Data is displayed at the cursor tooltip.



16. **Enter** to end the GIS Inspector command.

Lesson Review

In this lesson you learned how to Import an ESRI SHP file dataset for use in Carlson Software. You then learned how to utilize the GIS Inspector to inspect the data linked to the entities generated in the drawing.

6.10 Lesson: Place Image by World File

Introduction

Much aerial imagery is also available from a wide variety of sources, and several Carlson Software applications support the import and geo-referencing of these images. To do this, however, the world file associated with the image must be available.

Key Concepts

Concepts and key terms covered in this lesson are:

- World File
- TIF/TFW files
- JPG/JPW files
- SID/SDW files

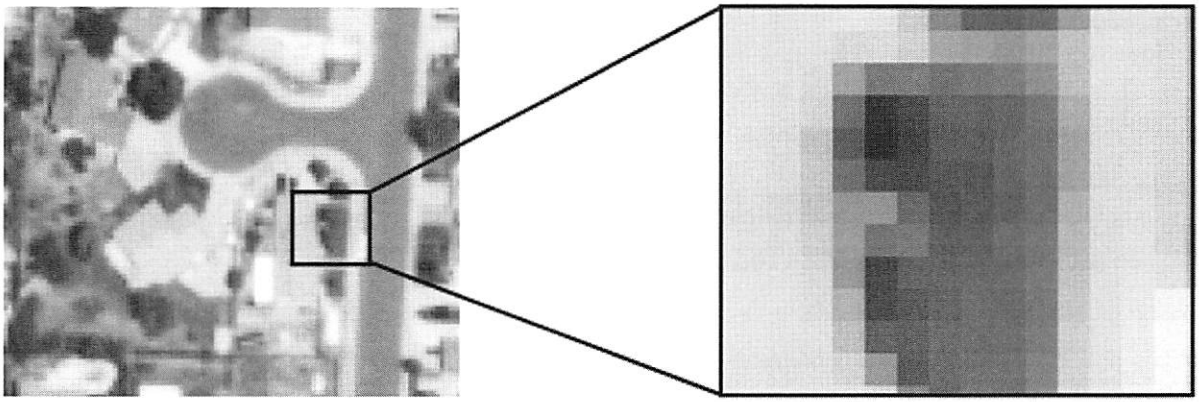
Objectives

After completing this lesson, you will be able to:

- Georeference an image using its associated World File

Raster Images Defined

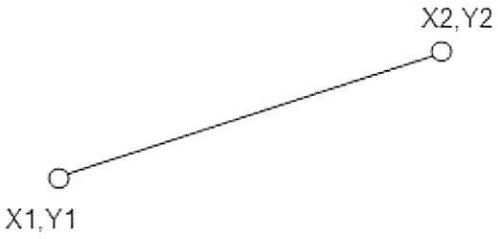
Raster images are files that use pixels to form the image. You can think of these pixels as a rectangular array with each cell having properties which determine how it is displayed. In the following example, you can see how each cell has a different value which is expressed by color or shade.



Raster Images Compared to Vector Objects

Raster images are unlike other objects in *Carlson* which are vector objects. Vector objects use precise start points, end points, center points, and so on to define the object. The definition of a vector object is used to "draw" the object on the screen.

In the following example, a vector line is defined by the start point (X1,Y1) and end point (X2,Y2). The line itself only exists as a definition, and not as a series of pixels that create a "picture" of a line.



Types of Raster

There are three primary types of raster that are used in *Carlson Software*:

- Bitonal
- Grey scale
- Color

Bitonal

Bitonal images are the simplest of all raster images. Each pixel is either on or off. On means the pixel is black, and off means the pixel is white. These images are commonly seen as faxes, or scans of text documents.

Grey Scale

Grey scale images use a graduated scale of white to black with shades of grey between. You most often see grey scale images as black and white photos.

Color

Color images provide various numbers of colors for each pixel from 256 to millions of colors.

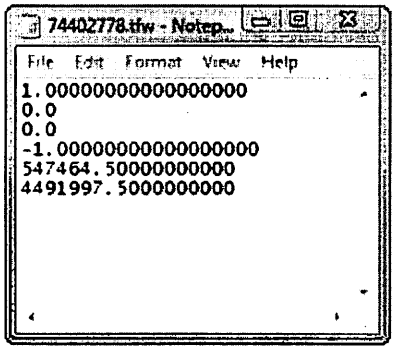
Sources of Mapping Images

In mapping there are several types of raster images and sources for those images. These include satellite images, ortho-corrected photos that are captured by aircraft, and scanned images of maps that are correlated to a coordinate system. There are also multi-spectral images, or remote sensing data that are used to analyze ground conditions such as vegetation, temperatures and so on.

Correlation Files

Most image formats that are used in *Carlson Software* require each image to have a correlation, or world file associated with it. World files contain data about the insertion point and units that the image uses to correctly locate itself in the map. The file name is the same as the image, with a different extension. For example, if you are using a .tif file, the world file has a .tfw extension.

The following is an example of the data in a world file.



The insertion points in world files are based on a coordinate system that was established when the world file was written. Note that the coordinate system itself is not included in the world file. Since there is no coordinate system defined in the world file, *Carlson* has no basis to convert the image from one coordinate system to another. This is a critical point. You must know what coordinate system is used in the world file, because your mapping system must adopt the coordinate system used in the raster image.

Exercise: Place Image by World File

In this exercise you insert a georeferenced image into a drawing, using its accompanying World File, to place it correctly.

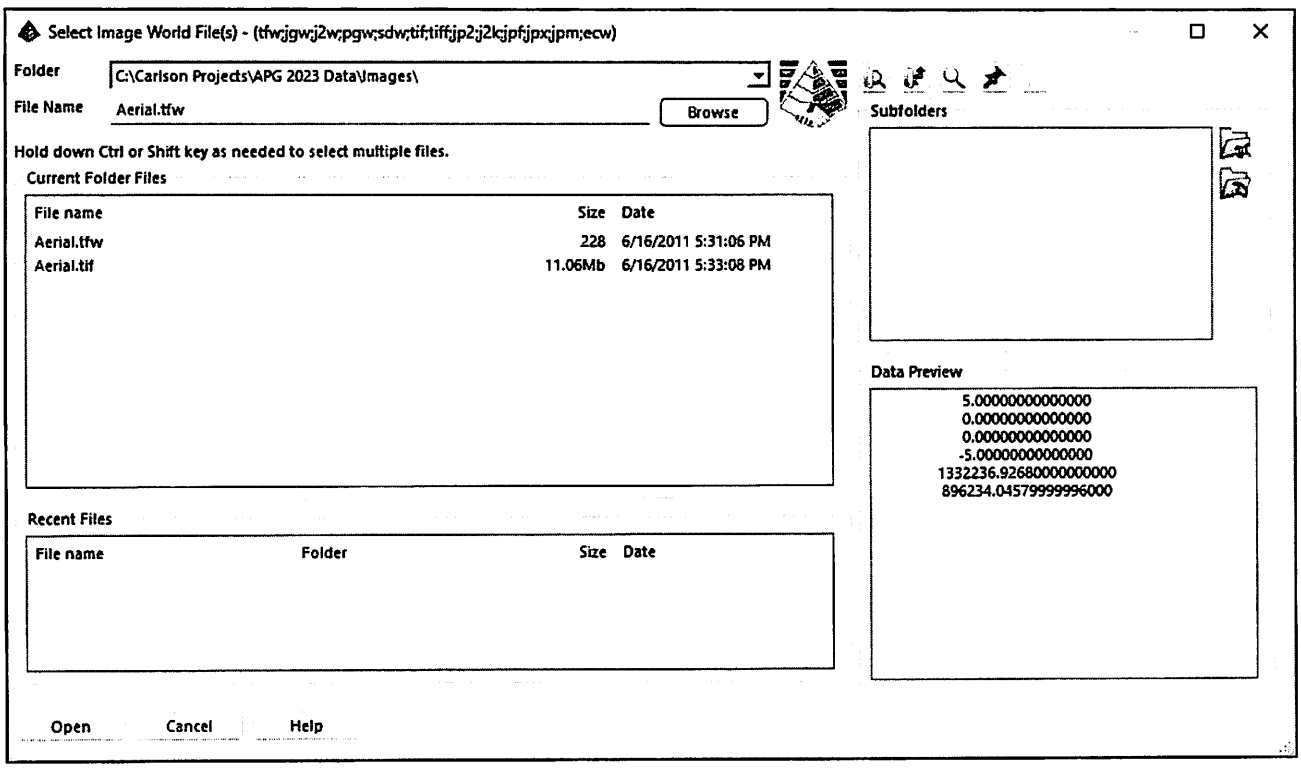
You do the following:

- Place Image by World File
- Send the image behind the linework

6.10.1 Place Image by World File

1. Open the drawing: **C:\Carlson Projects\APG 2023 Lesson 6_10\DWGS\6_10.dwg**

2. From the pull-down menu: Select **GIS ⇒ Place Image by World File.**



3. Browse to the file: **C:\Carlson Projects\APG 2023 Data\Images\Aerial.tfw**

4. Click **<<Open>>**.

5. Enable the **Place in background** option.

6. Click **<<OK>>**.

Now the parcel lines overlay the image.

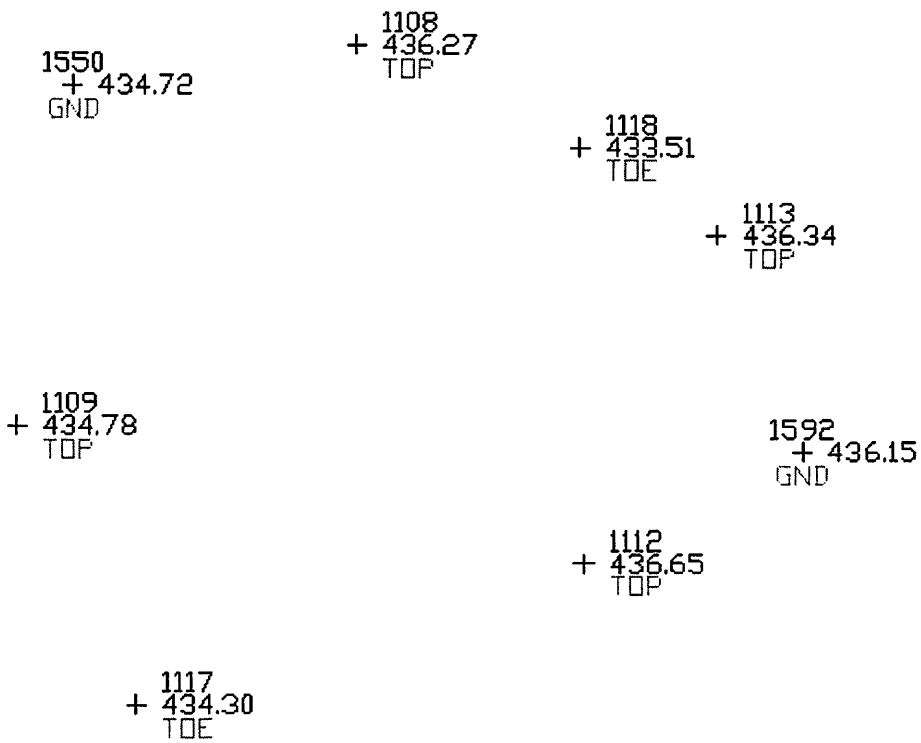
Lesson Review

In this lesson you learned how to place an image in a drawing using its associated World file to georeference it correctly.

6.11 Lesson: Working with Civil 3D Data

Introduction

It is common that a client, government agency, or even another department in your organization may ask you to provide a drawing for use in AutoCAD Civil 3D. In this lesson you will learn to convert a drawing containing Carlson points, Centerlines and TINs to a drawing containing Civil 3D Points, Alignments and Surfaces. You might also receive a drawing from an outside source that was created in Civil 3D. The data in that drawing will need to be converted into a Carlson format so you can use it.



Key Concepts

Concepts and key terms covered in this lesson are:

- Civil 3D Point Objects
- Civil 3D Alignment Objects
- Civil 3D Surface Objects
- Civil 3D Pipes
- Civil 3D Feature Lines
- Civil 3D Labels

Objectives

After completing this lesson, you will be able to:

- Create a new drawing containing AutoCAD Civil 3D Point Objects
- Convert a Civil 3D drawing into Carlson data

Overview

Autodesk AutoCAD Civil 3D uses custom ARX Objects to represent Points, Alignments, Surfaces and other Civil/Survey features that can only be used by that program. Carlson Software running on an AutoCAD Civil 3D platform is able to create Civil 3D Points by exporting Carlson point data to a LandXML file, or to an ASCII text file, and using a Civil 3D Import function to create them in a drawing as Civil 3D Objects. Carlson software, regardless of the CAD platform, can also create a new Drawing File containing Civil 3D Point Objects, Alignments and Surfaces.

When exporting a Carlson drawing to create Civil 3D objects the Points and Centerlines must be in the drawing file. However, the TIN does not need to be visible in the drawing, it is exported directly from the TIN file(s) that you specify.

Receiving drawings created in Civil 3D can also be problematic for people who do not have a copy of Civil 3D. The custom ARX objects can often be displayed, by either using object enablers or proxy graphics, however the data those objects represent is not available.

Importing Civil 3D Objects

Carlson Software can convert Civil 3D Points, Alignments, Surfaces, Feature Lines, Pipes, and Labels into AutoCAD objects and Carlson project data.

Exercises: Export and Import Civil 3D Data

In these exercises you convert a drawing containing Carlson points to a drawing containing Civil 3D points. Then you will open a Civil 3D drawing and convert its data to AutoCAD objects and Carlson project data.

You do the following:

- Export a drawing containing Carlson points to Civil 3D
- Open a Civil 3D drawing and convert its data to Carlson

6.11.1 Create a Drawing with Civil 3D Point Objects

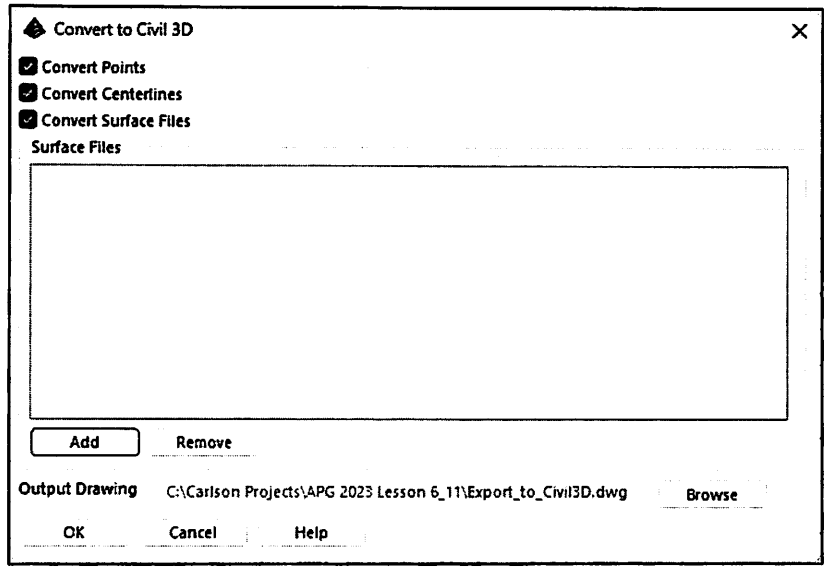
1. Open Drawing **C:\Carlson Projects\APG 2023 Lesson 6_11\DWGS\6_11.dwg**
2. Note that it contains Carlson Points.
3. From the pull-down menu: Select **File ⇒ Export ⇒ Civil 3D Drawing.**
4. Name the file **Export_to_Civil3D.dwg**.
5. Click **<<Save>>**.

6. In the Convert to Civil 3D dialog box, confirm **Convert Points** is enabled.

7. Confirm **Convert Centerlines** is enabled.

8. Confirm **Convert Surface Files** is enabled.

9. Click **<<Add>>**.



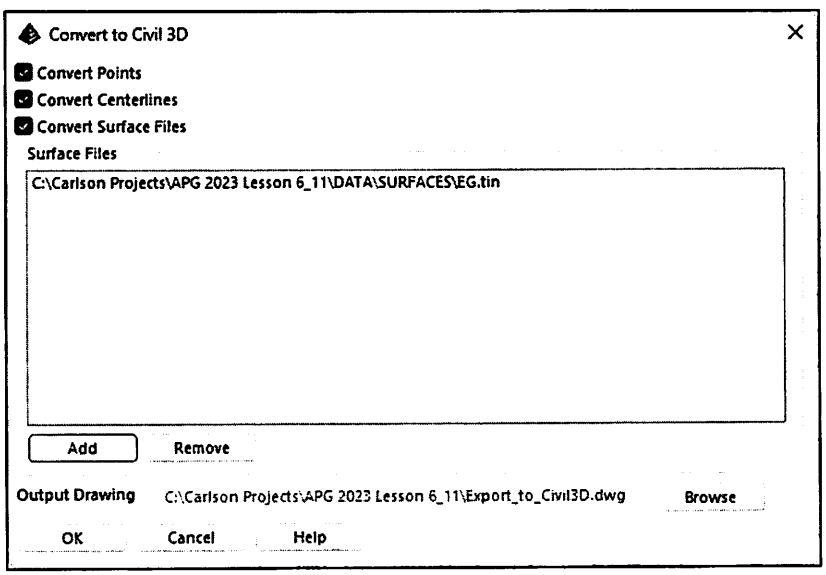
10. Browse and select: **C:\Carlson Projects\APG 2023 Lesson 6_11\Data\Surfaces\EG.tin**

11. Click **<<Open>>**.

Back in the Convert to Civil 3D dialog box you will see the surface listed. You have the option to select as many surfaces as you wish to export with this command.

The surface does not need to be displayed in the drawing it is exporting from the selected TIN file.

12. Click **<<OK>>**.



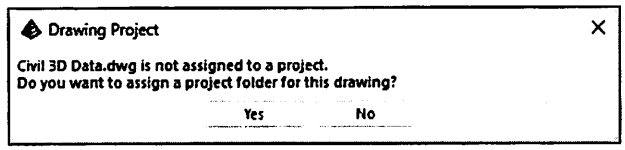
The new drawing is created with Civil 3D Point Objects.

If you have Civil 3D loaded on your computer open the new file you exported to see the drawing with Civil 3D Points, Alignment and Surface.

6.11.2 Import a Drawing with Civil 3D Data

1. Open Drawing **C:\Carlson Projects\APG 2023 Lesson 6_11\DWGS\Civil 3D Data.dwg**

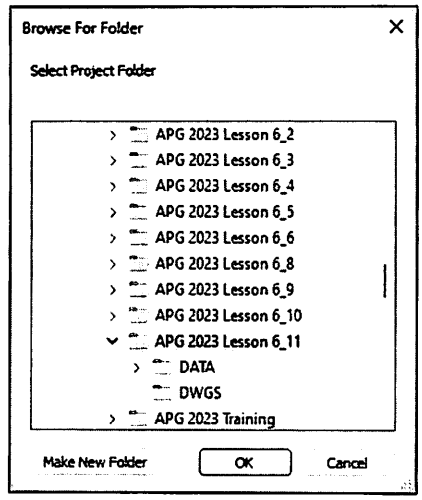
Since this drawing has not yet been associated with a Carlson project it will ask you to associate it with one.


Drawing Project
Civil 3D Data.dwg is not assigned to a project.
Do you want to assign a project folder for this drawing?
Yes
No

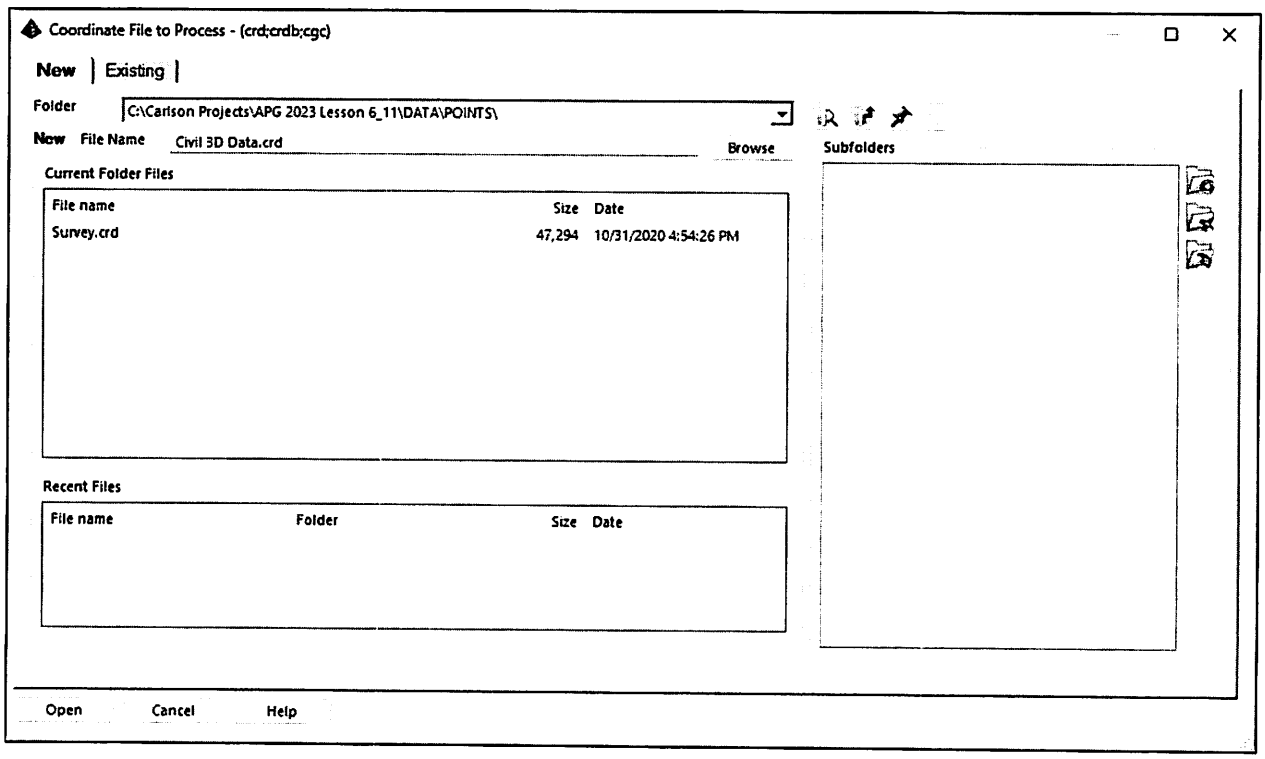
2. Click **<<Yes>>**.

3. Browse and select the project: **C:\Carlson Projects\APG 2023 Lesson 6_11**

4. Click **<<OK>>.**



5. From the pull-down menu: Select **File ⇒ Import ⇒ Civil 3D ⇒ All Civil 3D Objects.**



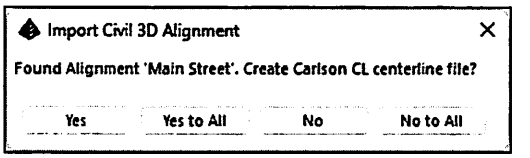
6. In the *Coordinate File to Process* dialog box select the **New** tab.

7. Confirm the name of the new coordinate file is **Civil 3D Data** and click **<<Open>>**.

8. At the command line enter **N** to use **Point Numbers**.

After processing the Points, if there are alignments in the drawing you will be asked if you want to create a *Carlson Centerline* file from them.

9. Click **<<Yes>>**.

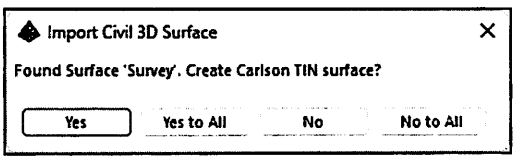


10. Accept the default name for the new *Centerline File* and click **<<Save>>**.

The default name comes from the name of the Civil 3D Alignment and the location was set in the project settings.

After processing the Alignment, if there are Surfaces in the drawing you will be asked if you want to create *Carlson TIN surfaces* file from them.

11. Click **<<Yes>>**.



12. Accept the default name for the new *TIN File* and click **<<Save>>**.

The default name comes from the name of the Civil 3D Surface and the location was set in the project settings.

At the command line you will get a report of what Civil 3D objects were converted and added to your Carlson drawing and project.

13. Zoom in and examine the drawing.

You will see:

- The Carlson Points are displayed according to the Point Defaults
- The contours from the Civil 3D Surface are now Polylines
- The Civil 3D Alignment is now a Polyline
- All Civil 3D labels are now AutoCAD MTEXT

Lesson Review

In this lesson you learned how to create a new Drawing file with Civil 3D Point Objects, and Alignment and a Surface from a Drawing containing Carlson Point blocks, a Centerline and a TIN file. You also opened a drawing created in Civil 3D and converted the Points, Surfaces, Alignments and Labels to AutoCAD objects with Carlson project data.

Congratulations!

Congratulations! You've made it successfully through your initial training, learning the fundamentals of *Carlson Software*. That was pretty painless, eh? With some practice and repetition, you'll join the ranks of *Carlson* masters in no time!

Once you've got all this reasonably under control, the *Carlson Software* product line has much, much, more to offer. But learn these fundamental things first. From here, you will choose what comes next, which features and functions, commands and capabilities best suit you and the tasks you have at hand.

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A Practical Guide to Carlson Software Fundamentals

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This Fundamentals text focuses on the critical tools common to all the Carlson office software. The mastery of this material is essential to any successful implementation, regardless of your specific area(s) of interest. The *Practical Guides* are designed to enable you to learn these features quickly and thoroughly, so you can immediately put them to work on your projects. Each lesson contains a discussion of the concepts and principles behind the task at hand, followed by hands-on exercises with detailed step-by-step instructions to reinforce the learning process. This approach ensures both a depth of understanding and a click-by-click ability to excel with the software.

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- Set up Carlson Software to use the Project approach
- Work with Coordinate Files
- Draw Points into the Drawing
- Edit Points in the Drawing and External Point Database
- Create Point Groups
- Prepare Surface Data using Points and 3D Polylines
- Create Surface Models
- View and Edit Surfaces
- Perform Surface Inquiries
- Generate and Label Contours
- Perform Basic Drawing and Editing in CAD
- Import and Export Land XML Data
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- Work with Centerlines
- Generate Linework Labels

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Rick Ellis has worked with and taught Civil/Survey CAD software since the mid-90s. He is the author of several critically acclaimed books on AutoCAD Map 3D and other CAD packages. This practical background and approach has earned Rick high ratings as a speaker at Autodesk University, and a spot on the national speaker team for the AUGI CAD Camps.

Doug Aaberg is the Survey Product manager for Carlson Software and a licensed Professional Land Surveyor in the Commonwealth of Massachusetts and the State of Colorado. Doug is a recognized expert in applying the continually expanding capabilities of Carlson's software to the everyday "workflow" of land surveyors and engineers.

Duke Gardner has served the land surveying and civil engineering communities for over 35 years in a wide variety of support roles. His focus on the theory as well as the practice skills needed to achieve successful implementation made him an excellent partner in the author team for this guide.

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